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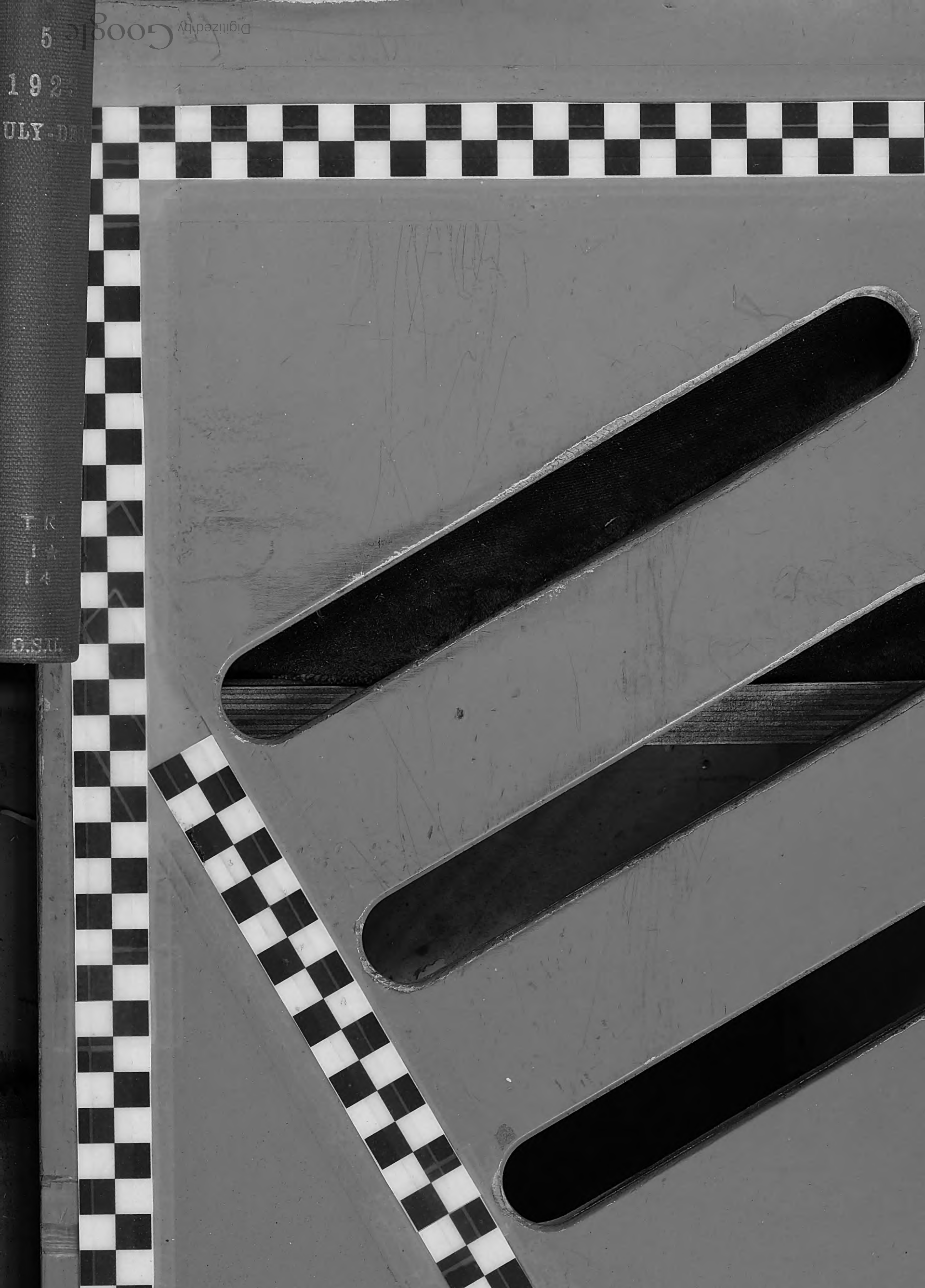
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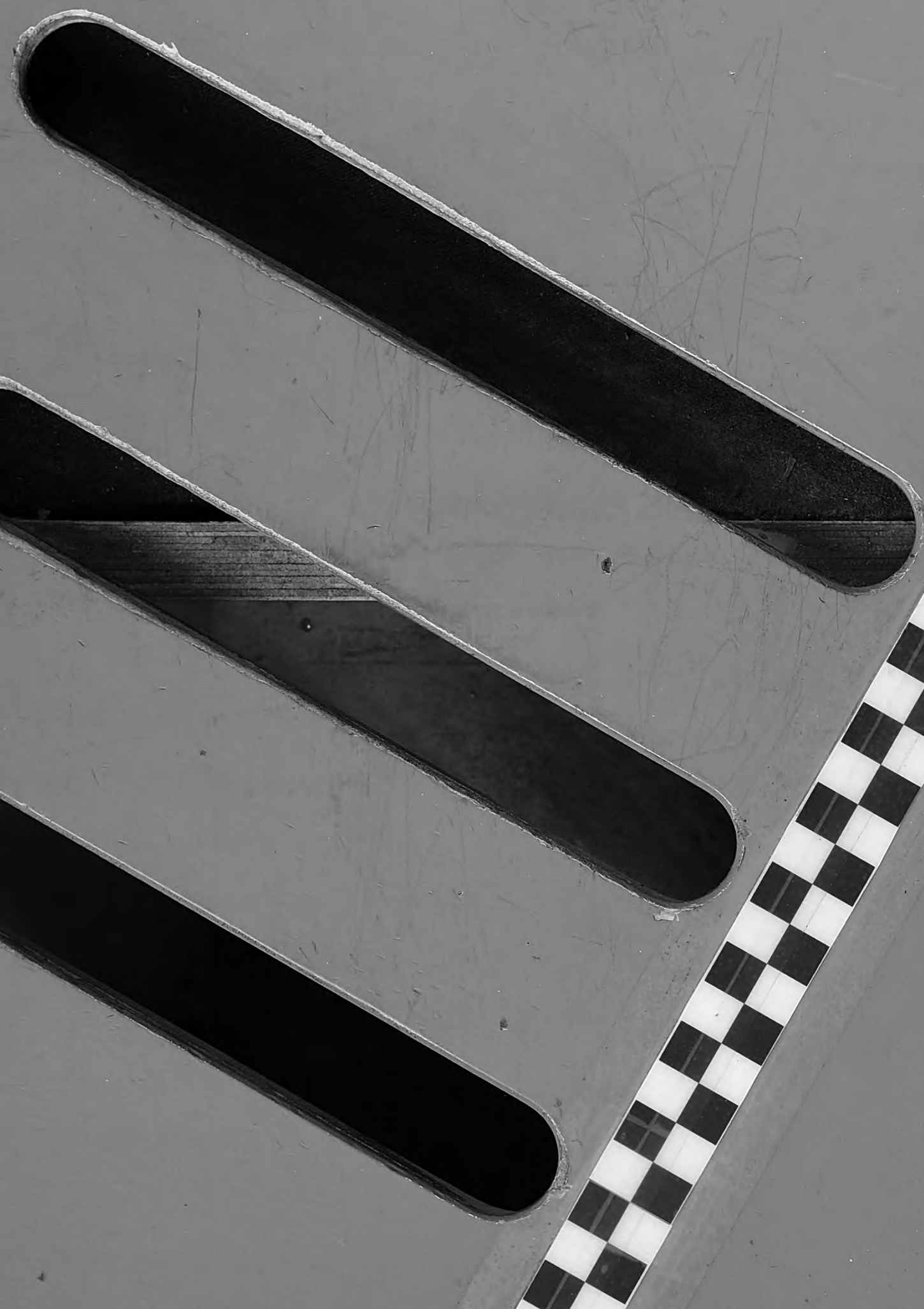
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Industry Illustrated

Vol. 5

1923

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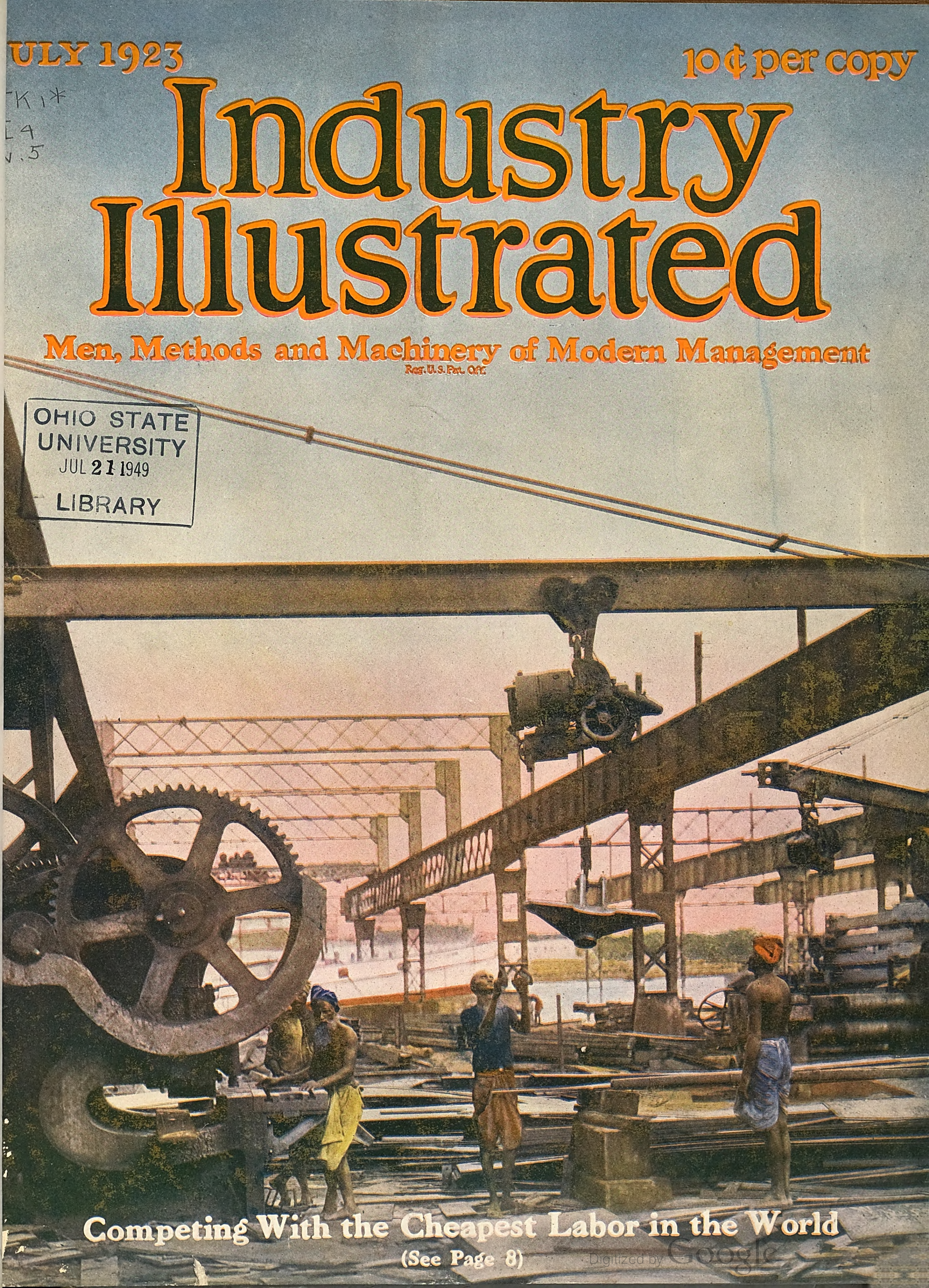
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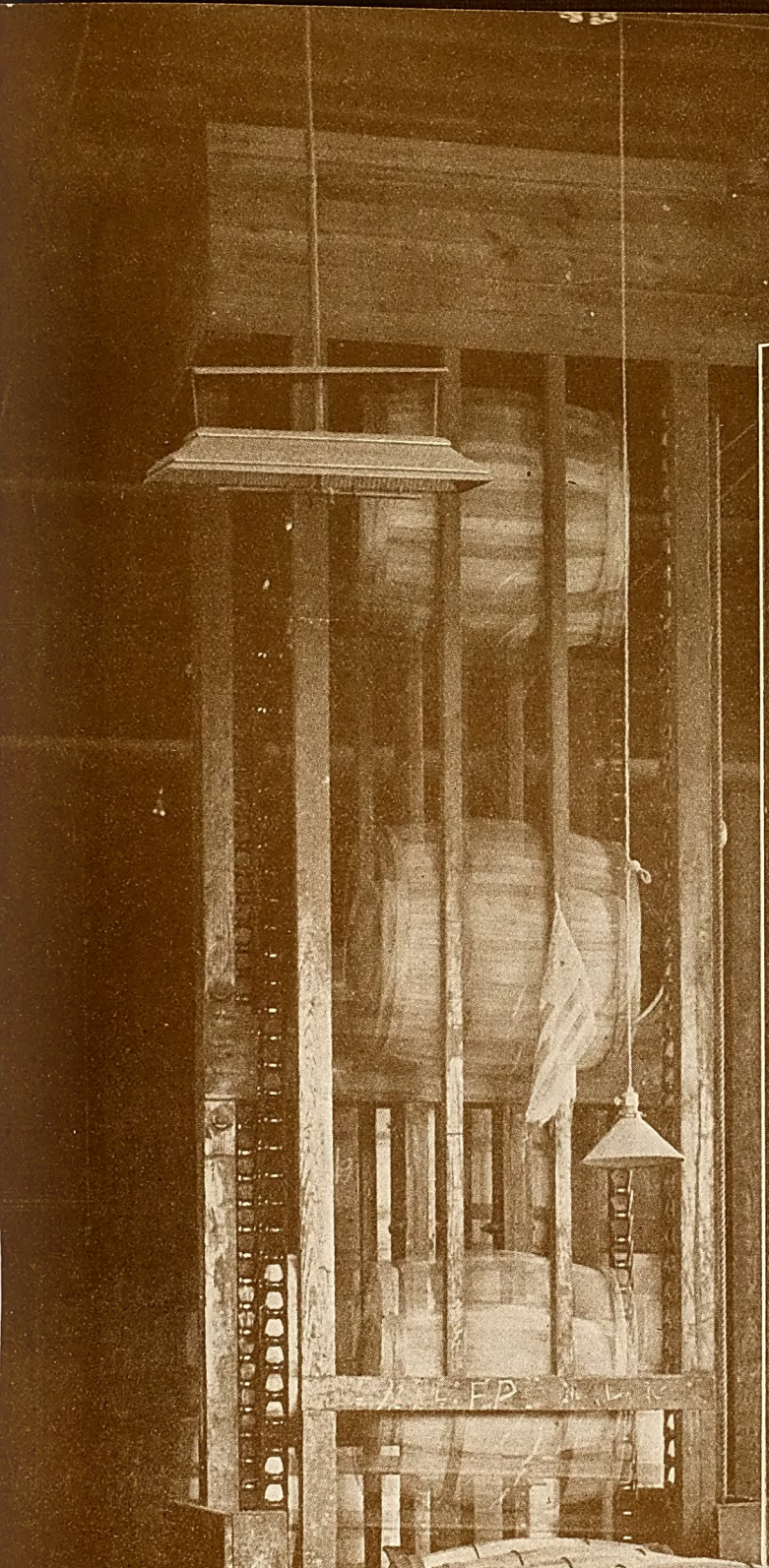


Competing With the Cheapest Labor in the World

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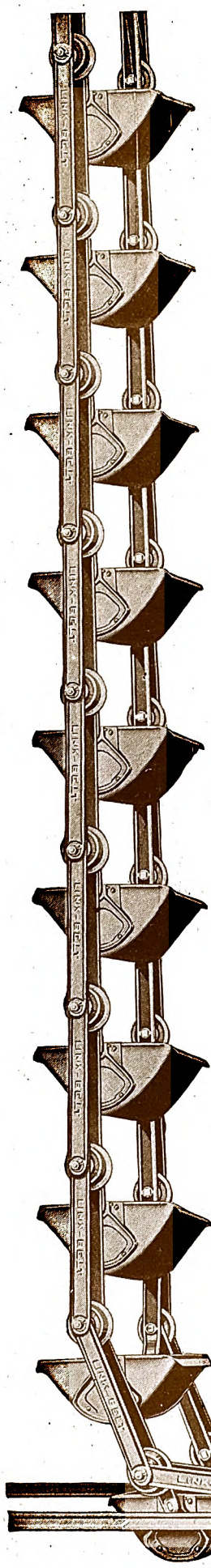
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Handles both coal and ashes with less upkeep than required for individual machines for coal and ashes.

Costs practically the same as elevators, conveyors, skip hoists and other equipment required to do same work—and is more dependable.

Operation and maintenance is less than for any other types of coal and ashes handling apparatus.

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Back of the Peck Carrier stands the reputation of this company—with hundreds of successful installations. Full particulars in Catalog 220.

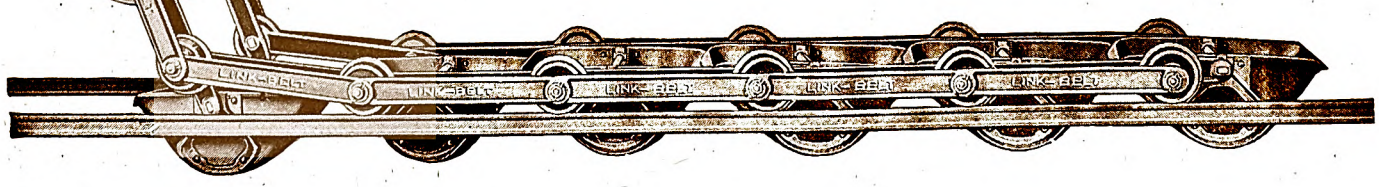
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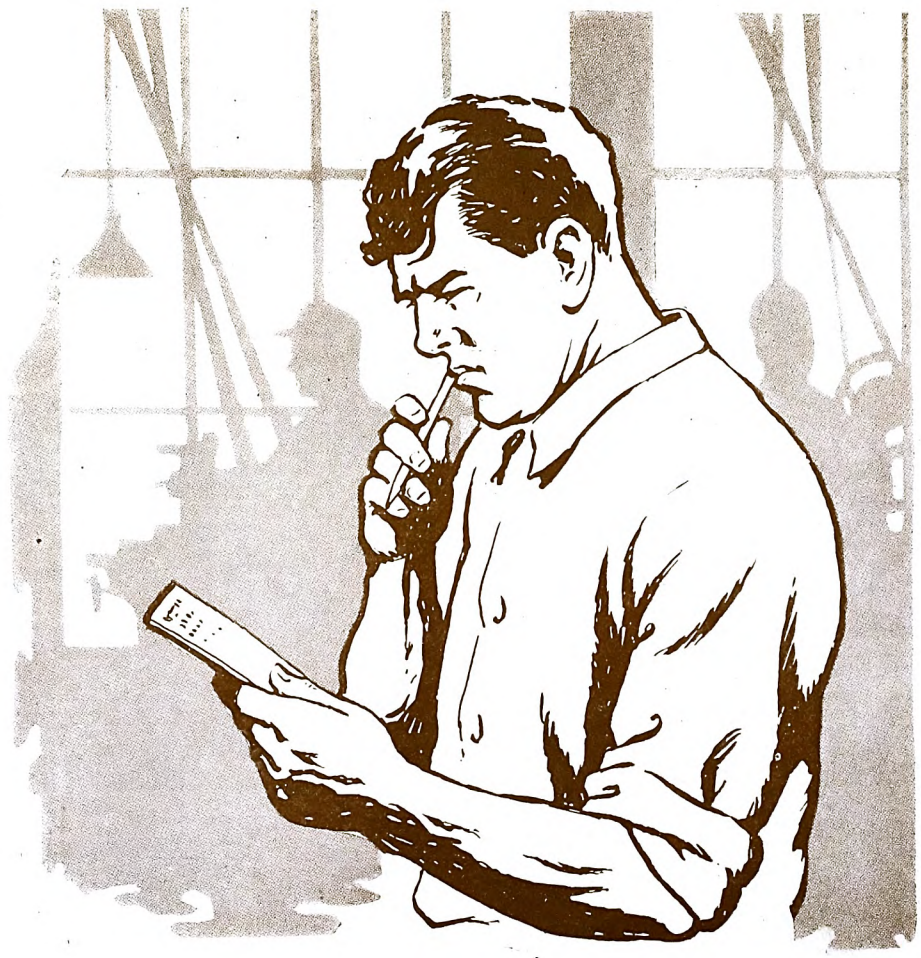
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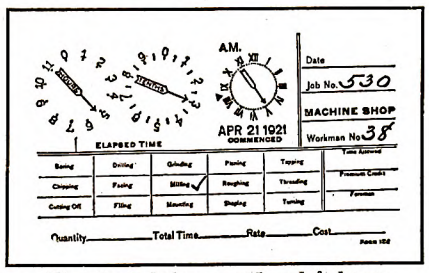
but the chances are he won't—and you pay

THIS workman, No. 38, started Job No. 530 on the milling machine at 8:24 A. M.

He has just finished (2.12 P. M.) and is trying to calculate the actual time spent on the job (*the elapsed time*).

He must deduct thirty minutes for lunch.

He may do it but it is a tedious operation, it takes him away from his productive work and the result will probably be incorrect.



The elapsed time was 5 and $\frac{1}{10}$ hours

The Calculagraph would give the answer instantly and accurately

The Calculagraph computes and prints *elapsed time* in hours and minutes or hours and tenths. It prints the starting time and date, also the finishing time and date. It makes records for any number of employees.

The Calculagraph will take cards of various sizes and shapes furnished by any printer. It operates very simply.

One backward-forward movement of the right hand Calculagraph lever when the job starts, a pull on the left-hand lever when the job is done, and the time record is complete.

The Calculagraph is practically tamper-proof

The Calculagraph is as nearly tamper-proof as a machine can be. The records cannot be falsified as shifting the hands of the clock will not in anyway change the *elapsed time* recording mechanism.

Calculagraphs have an eight day spring driven movement with jewel balances. There are no wiring or electrical connections to give a high maintenance cost or difficulty in moving.

Imprints are made from metal type through ribbon that is easy to insert and which reverses automatically.

The Calculagraph weighs only eighteen pounds yet it is durable—constructed to withstand hard usage in power houses, manufacturing plants, etc. It is absolutely guaranteed.



"Elapsed Time Records"

This is the title of a booklet which contains valuable time-keeping information. Those interested in labor cost and payroll records may have a free copy upon request.

Calculagraph Company

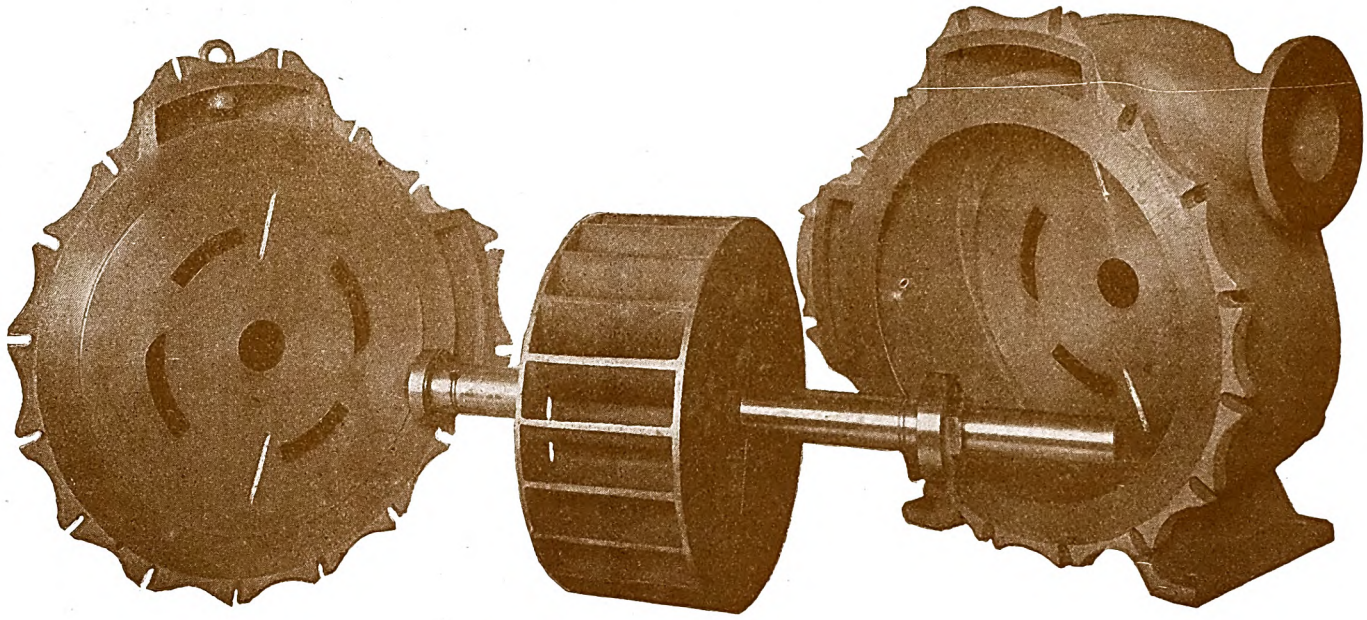
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ALL THE PARTS OF THE HYTOR

THE HYTOR COMPRESSOR is valveless, has no gears, loose moving or reciprocating parts, no piston packing to renew, no cylinders to lubricate, and no bearing adjustments to make.

The rotor, the only moving part, is cast in one piece, the blades being rigidly reinforced by shrouds. The rotor is mounted on a short, stiff shaft supported at each end by the highest grade annular ball bearings mounted outside of the casing.

As the peripheral clearance is large, there is no possibility of the ends of the rotor blades coming in contact with the casing.

The original high efficiency is maintained indefinitely in continuous service.

The air is thoroughly washed during compression and contains no oil.

Hytor compressors occupy very much less floor space and are much lighter in weight than reciprocating compressors.

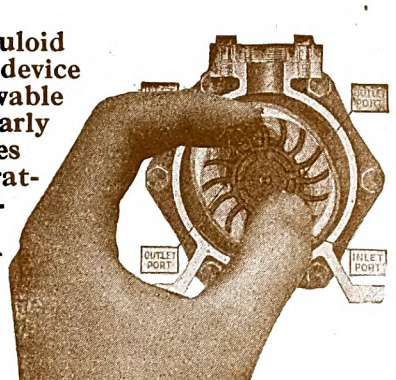
They run without vibration.

The cost of installation is greatly reduced as no expensive foundations are necessary.

No expert attendance is required as there are no adjustments to make. The cost of upkeep is negligible.

Hytor compressors are quiet in operation.

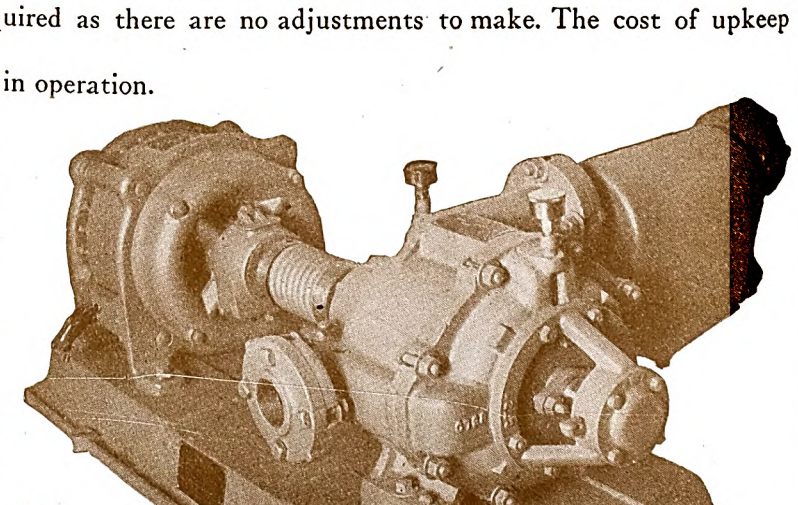
This celluloid graphic device with movable rotor clearly illustrates the operating principle. Send for your copy.



At pressures up to and including 15 lbs. per square inch, and vacuums up to 20 inches of mercury, the Nash Hytor affords the simplest and most economical means for handling air or gas, for all of the usual purposes where air under pressure is required, and they can be used on many special services for which the ordinary compressor is not adapted.

It is common practice in handling mildly acid vapors to re-circulate thru the pump an alkaline solution for the protection of the cast iron structure of the pump. In handling chlorine gas, concentrated sulphuric acid is re-circulated.

Air handled by the Hytor is delivered absolutely clean and free from dust or oil; a great advantage in the agitation of good products or in absorption processes where diffusion of air is accomplished by blowing thru filters, porous blankets or small orifices.



No. 1 Nash Hytor Compressor direct connected to electric motor. Capacity 100 cu. ft. per minute.

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EDITORIAL

Our Great Store of Common Labor

RECENT newspaper headlines have driven home to most of us the fact that in this country there is a very real and growing shortage of common labor. There may be a vast gulf between New York's twelve-dollar-a-day bricklayers and, for example, the four-dollar-a-day common laborer in the steel industry. Yet this gulf is as nothing compared to that between the wages of common labor in this country and in China or India; for the coolie laborer receives only about ten cents a day—or roughly, one-fortieth of what his American prototype demands.

At first thought, there would seem to be an obvious connection here: On the one hand, America, with a shortage of common labor; on the other, China, India—and to a lesser degree, the European countries—with a vast surplus of laborers accustomed to low wages. But let us look behind this immediate picture for a moment.

In no other country has industrial progress reached as high a state of development as in the United States. In the production of automobiles, of tools, of steel, of machinery, this country leads the world. But in another, and vastly more important respect too, this country leads the world:—in the scale of living of the worker. And this last—most important because it is of benefit to the greatest number—is only true and only possible because American labor, through the use of machinery and mechanical power, is more productive than labor anywhere else in the world.

At the extreme opposite end of the scale, India and China, with their teeming millions and with untold wealth in natural resources, are today less advanced, industrially, than America was fifty years ago. Coolie wages, at best, suffice only to ward off starvation. The vast majority of the population in the Orient exist in a state of pitiful wretchedness.

Some of our manufacturers, fascinated by the idea of "cheap labor," would have this country lift the present immigration restrictions—would admit hordes of foreign laborers, irrespective of any danger to our established institutions—as a solution to our labor shortage.

There is a confusion of terms here. We do need more common labor; but it is not more *human* labor that we need—it is a greater use of our store of *accumulated* labor. To import cheap and inefficient labor would merely result in lowering the average productiveness of labor in this country; and inevitably that would carry with it a lowered standard of living for the worker.

For the past seven or eight decades, American ingenuity has been transforming unskilled workers into skilled or semi-skilled workers. Machines of almost uncanny ability have lightened the labor of individual workers, and at the same time have so increased their productive power as to make this labor more valuable.

What many of us fail to appreciate is, that this process has become cumulative: a portion of the increased productiveness has gone to the worker; a portion has gone to the employer; but by far the greater portion of this increased productiveness has gone into machinery which makes ever lighter the labor burden of succeeding generations. And it is this *stored up labor*—tireless, cheap, efficient, labor-saving machinery—that must perform the common labor, now, and increasingly in the future.

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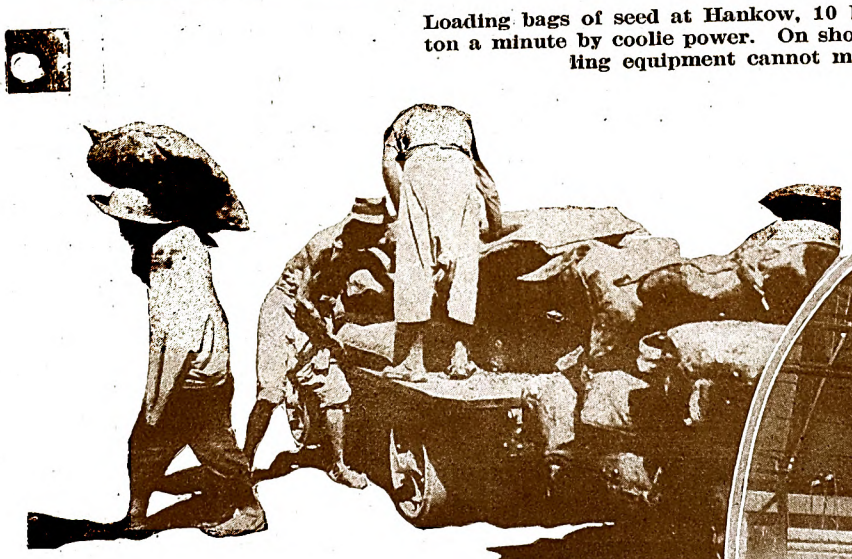
Competing with the Cheapest

Materials Handling

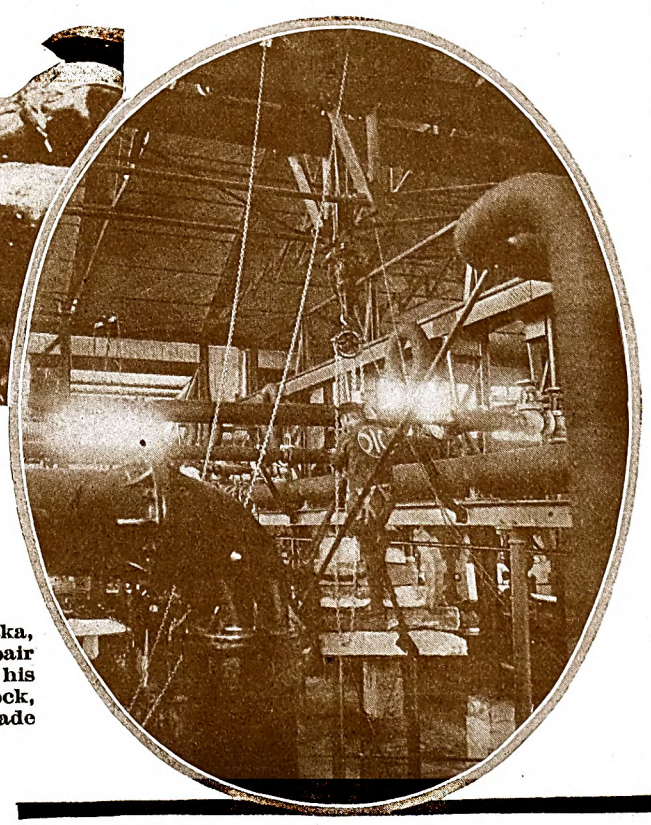
BY F. C



Loading bags of seed at Hankow, 10 bags to the ton, at the rate of a ton a minute by coolie power. On short hauls, modern materials handling equipment cannot meet this competition.



On long hauls, however, such as from dock to distant warehouse, or to delivery point, the industrial truck and trailer puts the coolie out of the running.



In the Municipal Water Works at Osaka, Japanese prisoners are used to do the repair work. Note the Jap prisoner rides with his load on an American-made chain block, which is suspended from an American-made hand-operated traveling crane.

IN the Far East, no suc
thing as a labor shorta
is known and consequent
with plenty of labor availabl
and to be had at the rate of
few cents a day, it might seem
at first thought, to be ridic
lous for American manufa
turers to expend any effort i
cultivating what is apparent
such unproductive territory.

Taken as a whole, the F
East is a poor territory
which to try to introduce t
Occident's conception of m
terials handling. But, in th
large sea-port cities, despi
the plentitude of common labo
and its cheapness, there is
real place for the use of me
chanical handling devices. Th
application of this equipme
has been recognized, as was
be expected, by American an
European trained engineers
and much of the equipment ha
been introduced as a result o
their missionary work.

In applying the use of indus

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Labor in the World

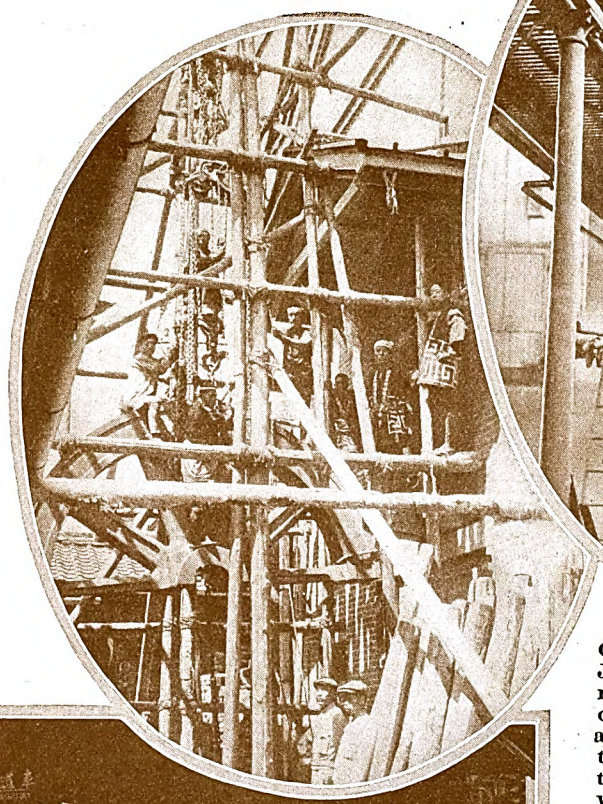
in the Orient

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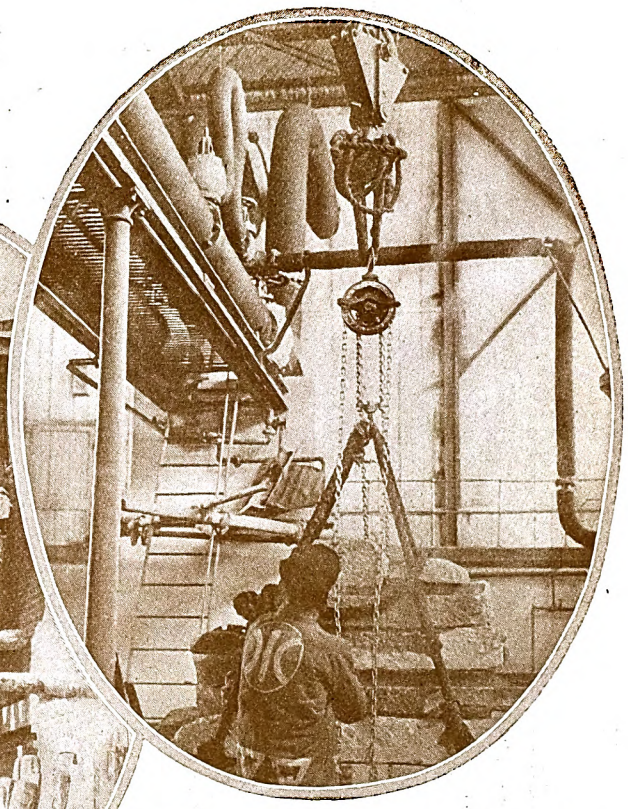
trial trucks to Chinese warehouse and dock conditions, the two places where this equipment has met with success in use, we must keep in mind the fact that Chinese roadways are very poor. In fact, they do not know how to build roads and it is necessary to teach them not only how to operate and care for an industrial truck but also how to build a road for it to operate on. It has been found profitable for these users to lay a new and complete system of roads around the warehouses. Thus the trucks are enabled to perform their work with the greatest efficiency. However, even where good roads were not available, industrial trucks proved their value for hauling heavy loads over distances of several hundred yards.

In the construction of the foreign settlement in one of the suburbs of Shanghai an American platform industrial truck with six trailers entered into competition with coolie labor. It was used to haul concrete, 350 pound baskets of mud, and from six to eight coolies on each trip. It traversed the roughest of ground with complete reliability and unusual speed. Its loads averaged about 9,000 pounds and it covered a dis-

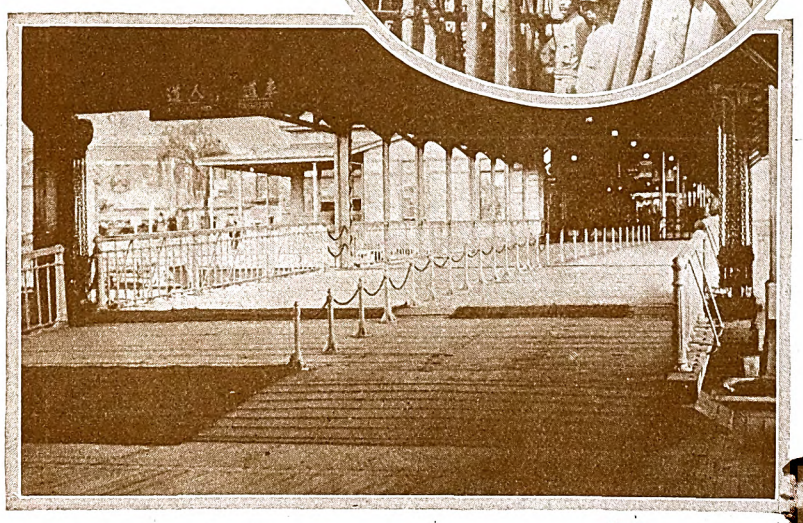
(*Continued on page 45*)



A contrast of the Occident and the Orient. Japanese workmen built this wooden rig, braced with bamboo poles and tied, not nailed, together. The huge casting is being lifted into place by means of a chain block of American manufacture.



Getting ready for a masonry job. This Japanese prisoner is using an American-made chain block. This is another view of the Municipal Water Works at Osaka and contrasts the American methods with those of the Japanese. You can distinctly see the bracings lashed together with heavy cord at the left, behind the load of stone.



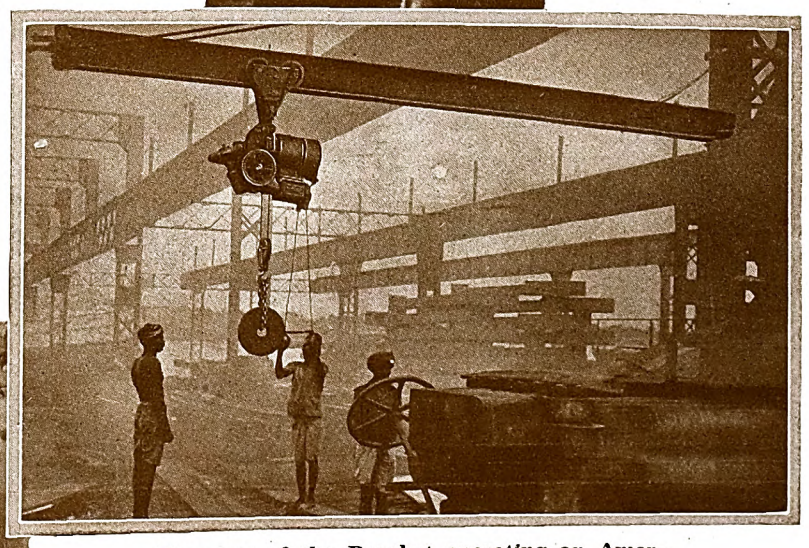
At this Japanese ferry slip, American-made chain blocks are used to raise and lower the gang plank.



A loaded American-manufactured industrial truck competing with coolie labor in the shadow of the world-known exporting house of Mackenzie & Co. The truck carries 4,000 pounds—the coolies 200 pounds each.

Somehow, there is something incongruous to our occidental eyes, in a scene such as this. It is worth studying, however, if it helps to drive home the idea that mechanical methods are winning their way even in China, where common labor is paid but a few cents a day.





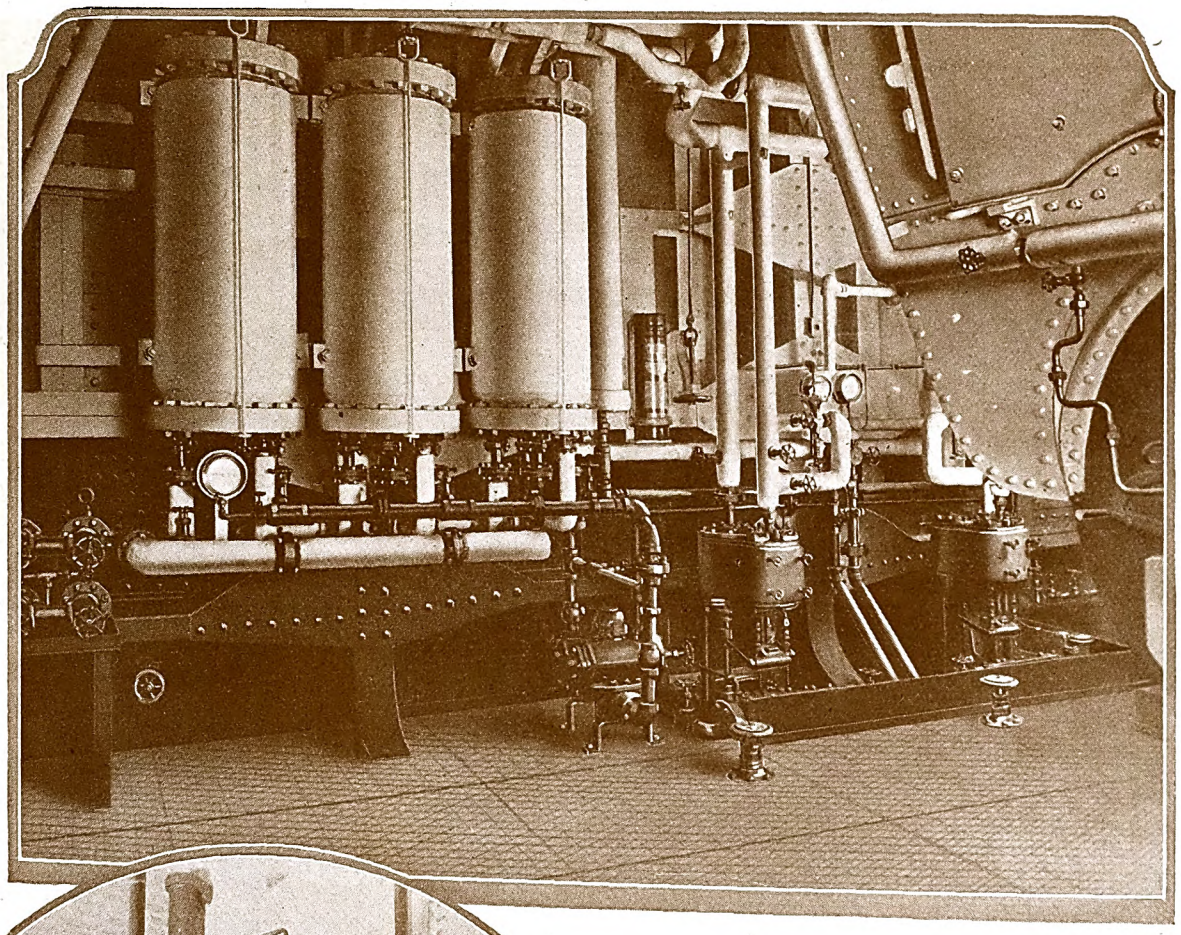
The sons of the Prophet operating an American-built electric hoist, in this Indian shipyard. (Another view of this yard is shown on our cover.)

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The Why and How of Pre-Heating Fuel Oil

Auxilliary Equipment that has Revolutionized Oil Burning

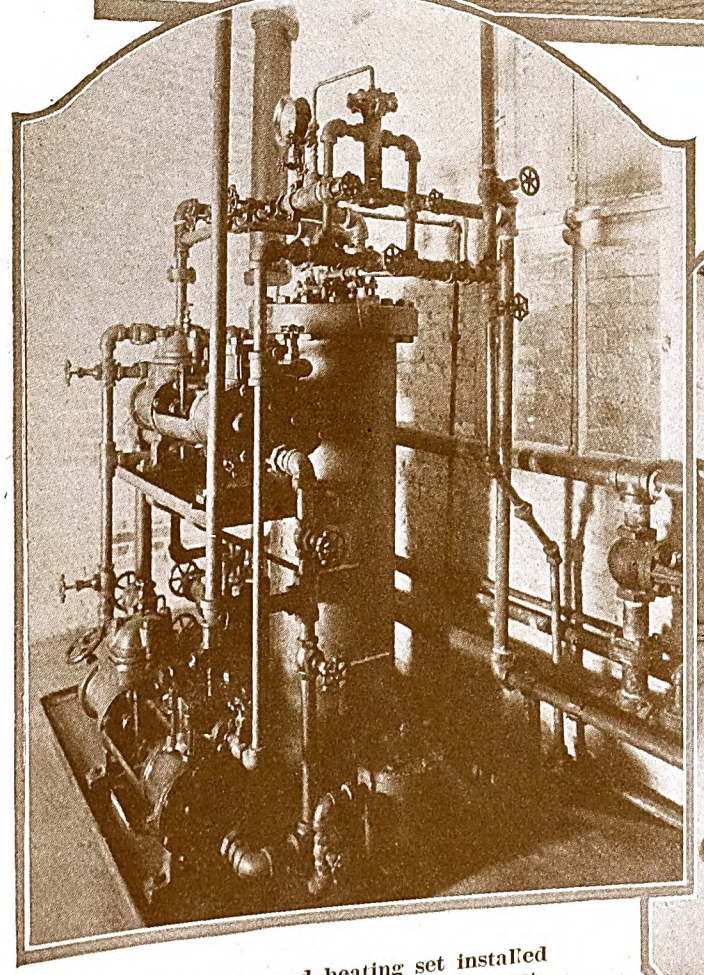
ALLEN F. BREWER



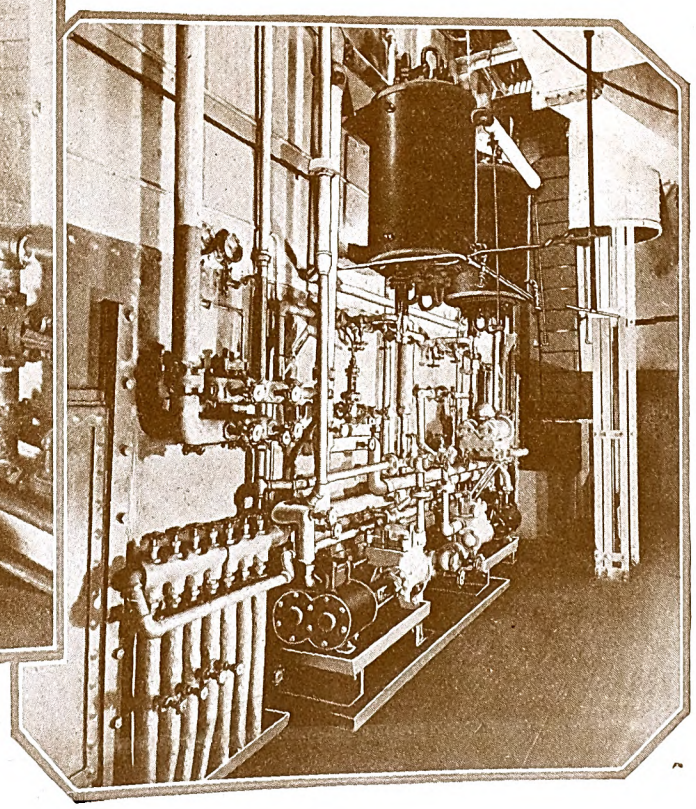
Series of three coil type fuel oil heaters installed for marine service.

OVER the past twenty years the use of fuel oil for industrial, stationary and marine purposes has been developed from an embryo experimental stage to a veritable science, and a multitude of equipment has been perfected to bring about the most complete combustion possible. In fact it may be safely stated that it is chiefly due to modern firing and handling apparatus such as burners, heaters, pumps and strainers, that fuel oil has attained its enviable reputation as being the ideal fuel of the industrial world today. Relatively speaking, fuel oil requires more preliminary treatment than coal before it can be fired. For example, it must be strained, pre-heated, raised to a certain pressure and atomized in order to bring about proper combustion.

Of the above steps, pre-heating has perhaps the most bearing upon combustion efficiency. No matter how perfected the burner may be it will be prac-

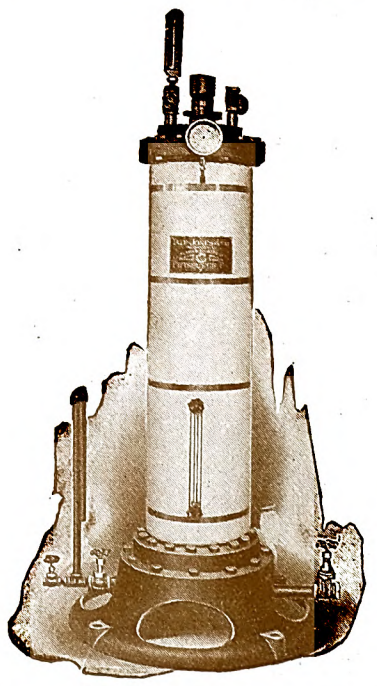


Fuel oil pumping and heating set installed for stationary service. Especial compactness of equipment is attained by installing the heater vertically.

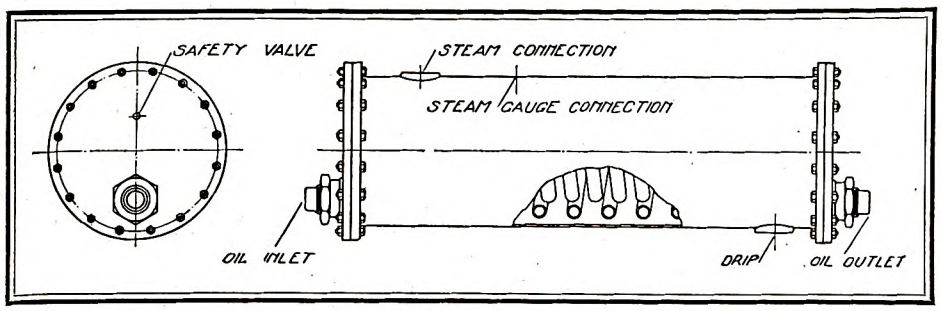


Installation of coil type heaters on board a 12,000-ton freighter. In this plant the heaters are located overhead, above the pumps, in order to conserve space in the fireroom as much as possible.

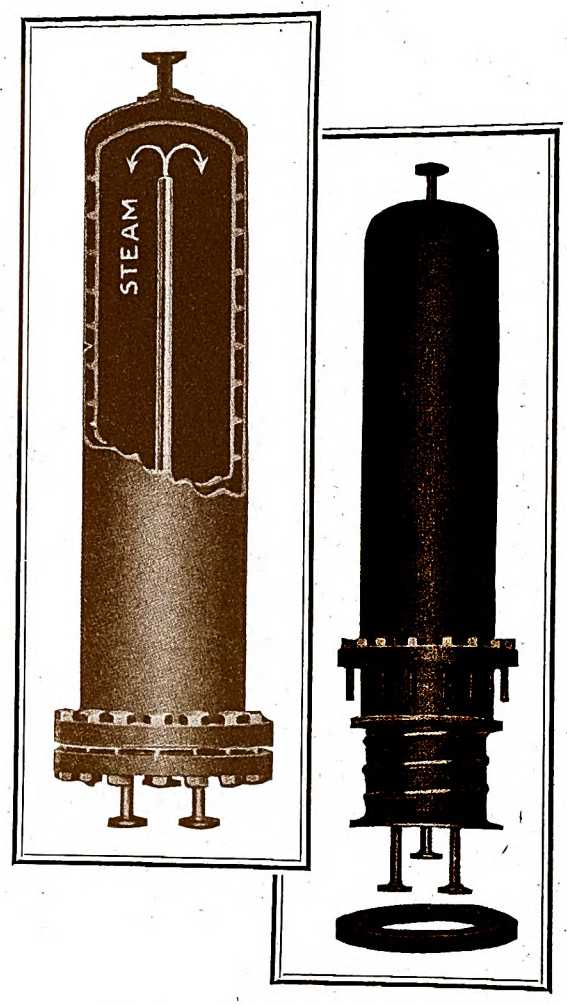
Vertical type of fuel oil heater showing necessary attachments such as thermometer, pressure gage, and connections. Live and exhaust steam are admitted to the coil through suitable inlets at the top, while the oil enters at the bottom. Thus counterflow of the oil and steam is obtained.



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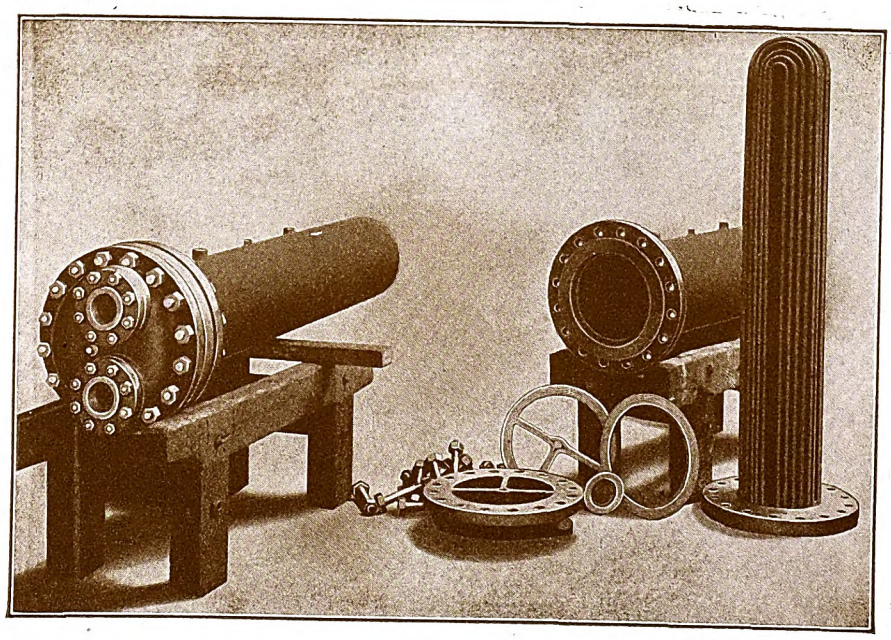
Fuel Oil heater, built for either horizontal or vertical installation. All steam and oil joints are external, the heating element being an endless coil of wrought iron or steel pipe, or seamless steel tubing.



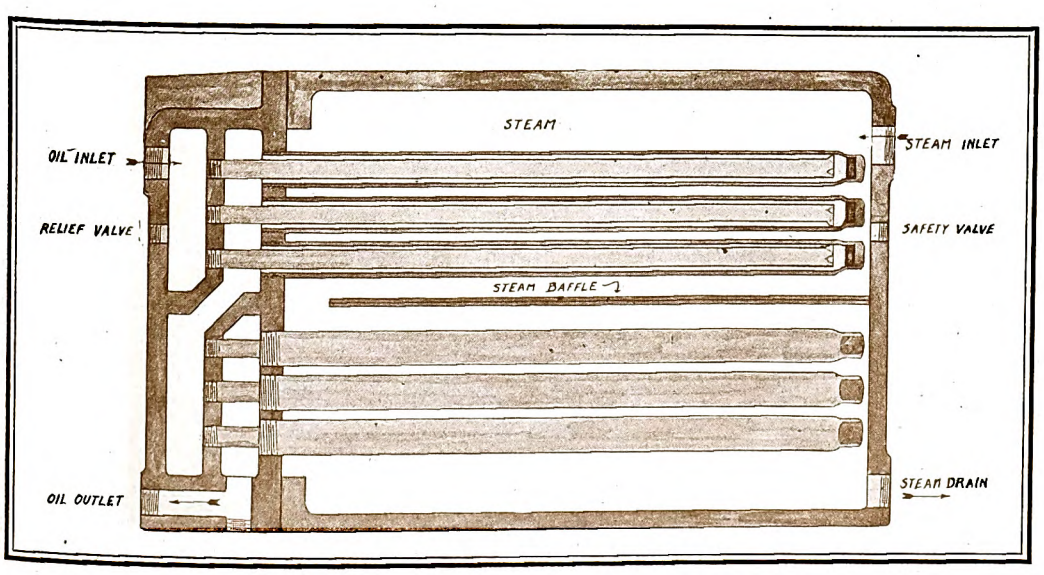
Cone spiral film type of pressed steel cleanable fuel oil heater. The features of this heater are that there are no copper coils to be attached by sulphur in the oil; and the shell is of pressed steel thus affording maximum strength with minimum weight.

tically impossible to obtain complete atomization of the oil if it is not properly heated. Likewise, pumping will be affected inasmuch as, if the oil is not sufficiently heated, it may become so sluggish as to flow intermittently and cause a decrease in fuel delivery to the burner. Another result of insufficient heating will be an excess of smoke due to incomplete combustion. Too high an oil temperature will, on the other hand entail unsteady burning of the oil due to pulsation, frequent carbonization of the oil both at the burner tip and in the oil piping directly in back of the burner, and oftentimes serious damage to the boiler setting, baffles and tubes.

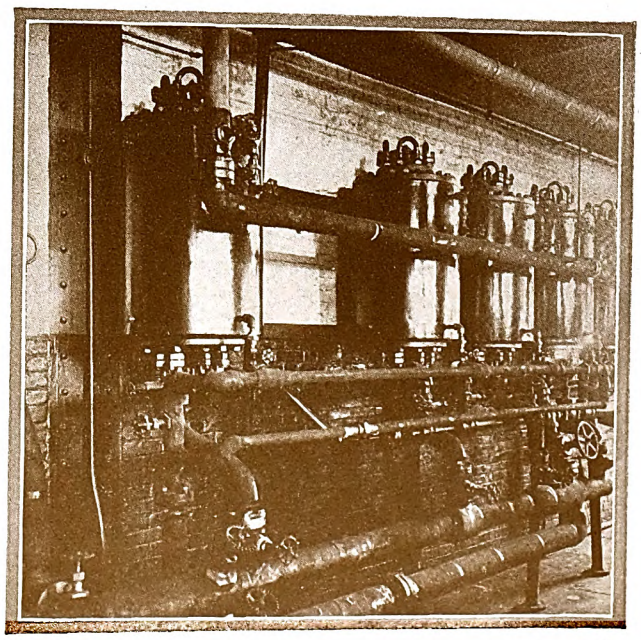
The extent to which fuel oils should be pre-heated will depend largely upon their Baumé gravity and viscosity. In fact it is the opinion of authorities that there is a theoretical temperature for every grade of oil, according to its above characteristics at which maximum atomization will be possible at the burner. Many experiments have been carried out in this regard and considerable data compiled. Within certain limits this can be condensed to the figures shown in the accompanying table.



This heater usually operates with the oil inside the tubes, the steam being passed through the shell and surrounding them. This is a form of multi-pass return tubular heater.

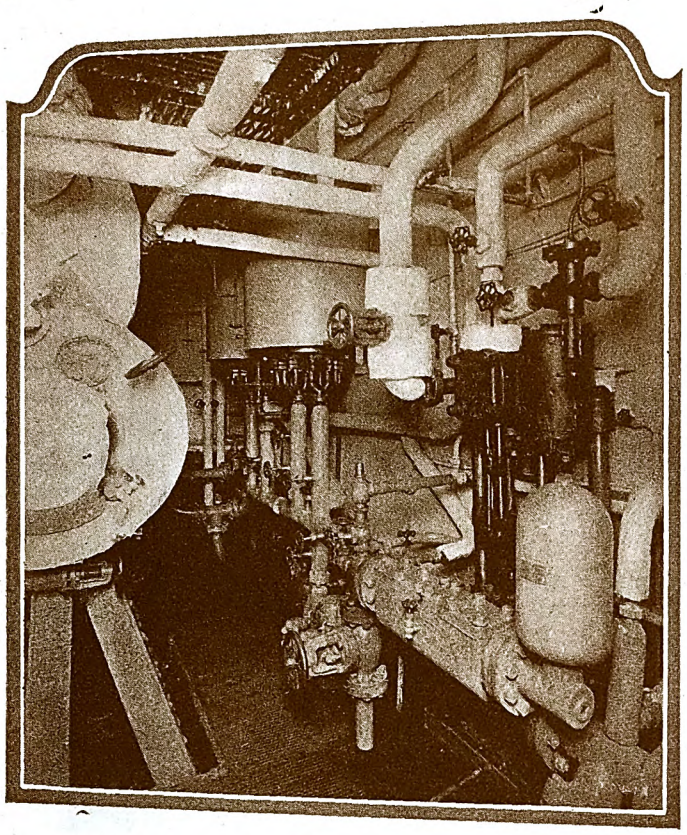


Multi-pass film type porcupine oil heater—sectional view. This heater consists of steel tubes in a cast iron shell. By means of film heating and the multi-pass effect maximum heat transfer per unit of surface is obtained.

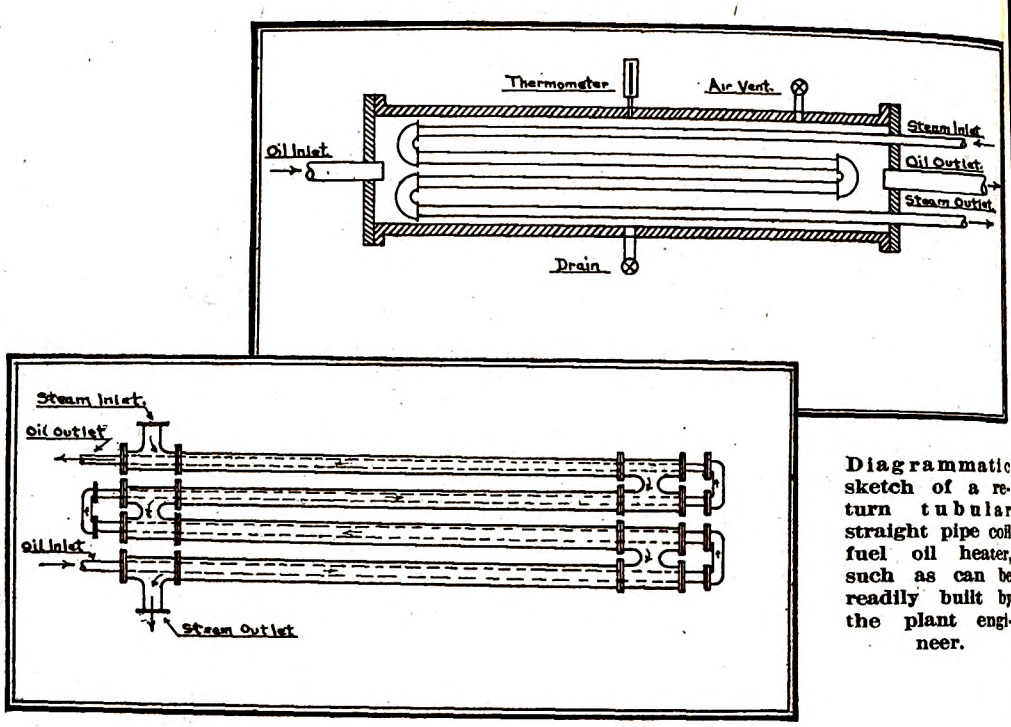


Installation of coil type oil heaters in Quincy Point Power House of Eastern Massachusetts Street Railway Company.

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Installation of coil type oil heaters on board S. S. Pan America.



Diagrammatic outline of a double pipe coil fuel oil heater.

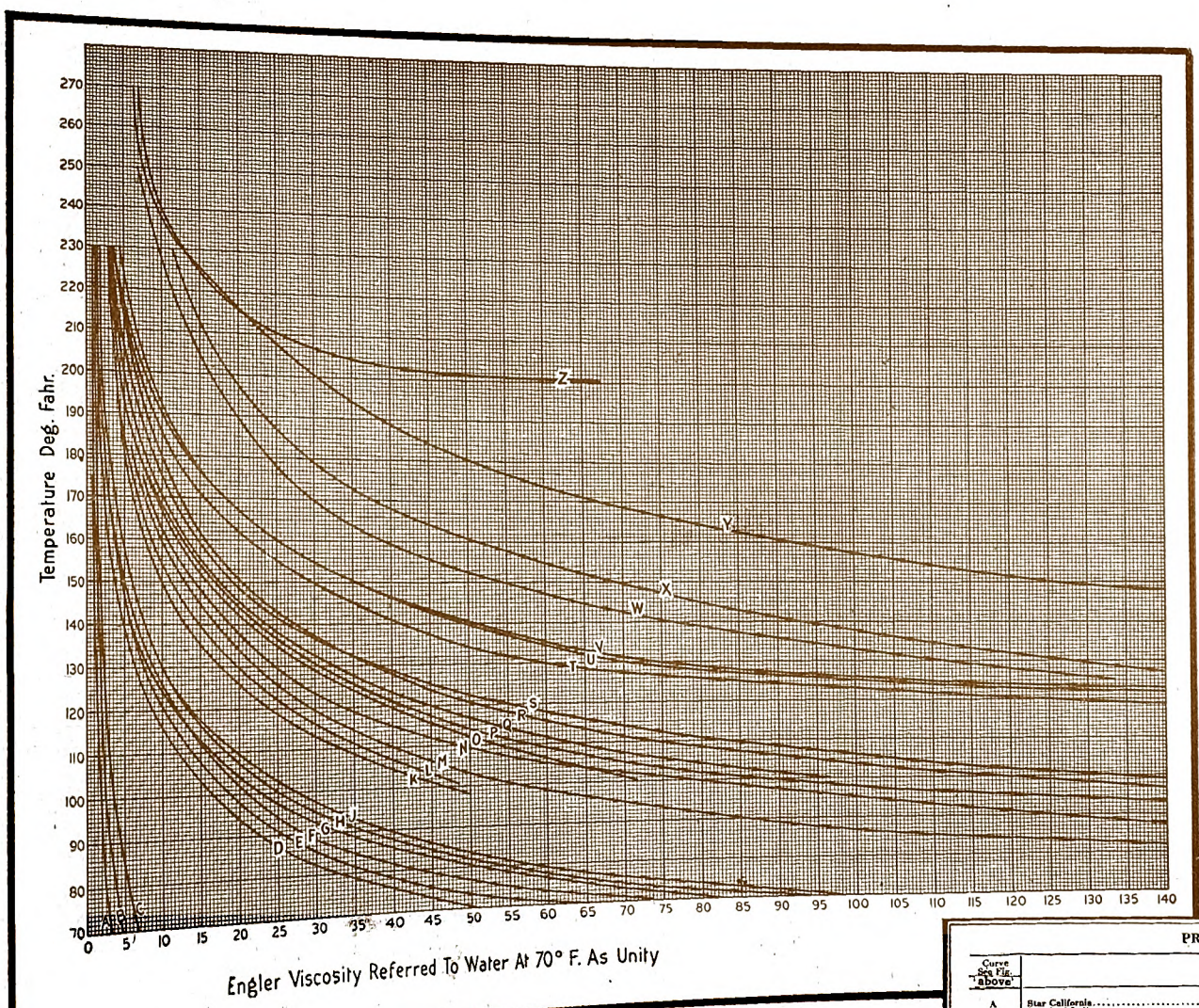
Diagrammatic sketch of a return tubular straight pipe coil fuel oil heater, such as can be readily built by the plant engineer.

TABLE OF GRAVITIES AND CORRESPONDING PRE-HEATING TEMPERATURES

Baumé Gravity	Temp. Deg. F.
10-12	280-300
12-14	270-280
14-16	250-270
16-18	200-240
18-20	170-200
20-24	160-170
24-28	150-160
28-35	140-150

While heavier oils such as Mexican crudes, and certain grades of topped fuel oils, which originally contained a low percentage of lighter products such as gasoline and kerosene, will in general require a relatively high degree of pre-heat, there is little or no danger involved. Such oils may frequently require heating above their flash points, but due to the slight amount of lighter products which they contain which would have a tendency to flash at lower temperatures, there will be scarcely any possibility of fire occurring. In marine practice, however, even the slightest fire hazzard must be guarded against hence it is customary to observe the rule of never heating above the flash point of the oil.

The development of the fuel oil heater from the crude re-

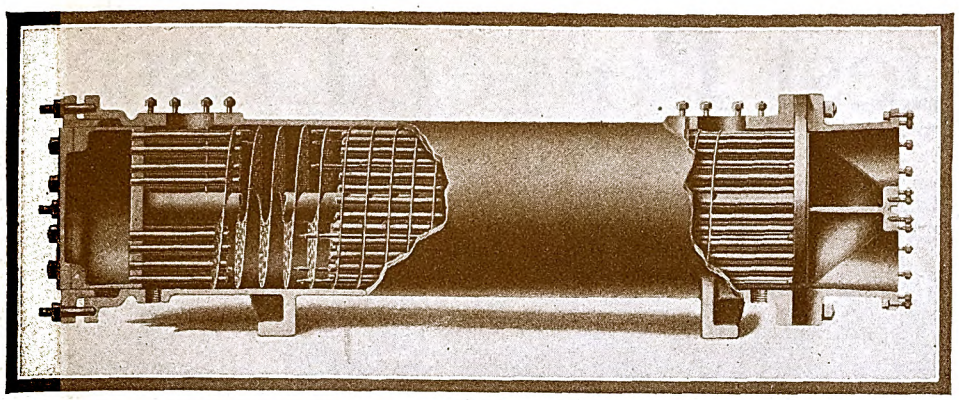


Viscosity-temperature curves of more usual grades of heavy fuel oils as specified in table shown on the right.

PROPERTIES OF HEAVY FUEL OILS

Curve See Fig. above	Source of Oil	Deg. Baume	Flash Point Deg. Fahr.
A	Star California	23.9	180
B	Standard Indiana	29.6	144
C	Standard Illinois	27.2	166
D	Sun Co. Louisiana	19.2	275
E	Avon Refinery Associated Oil Co., California	17.1	168
F	Coalinga Field Associated Oil Co., Monterey, California	16.5	186
G	Richmond, California	17.1	228
H	Oleum Residuum No. 2 Fuel Oil, Union Oil Co., Calif.	16.5	221
I	Producers Crude No. 1 Fuel Oil, Union Oil Co., Calif.	16.1	174
K	Nos. 1, 2 and 3, Anglo Mexican Petroleum Products Co.	16.8	188
L	Mexican Oil From U. S. S. Arethusa	17.6	162
M	Texas Co., Reduced Mexican Crude	17.3	162
N	Standard Mexican Crude	17.0	145
O	Sample No. 2, Anglo Mexican Petroleum Products Co.	16.2	238
P	Gaviota Refinery Associated Oil Co., Calif.	17.1	230
Q	Sample No. 3, Anglo Mexican Petroleum Products Co.	17.3	184
R	Texas Co. Mexican Crude	17.3	126
S	Standard Mexican Crude	15.4	262
T	No. 25 Union Oil Co., Bakersville, Calif.	13.2	262
U	No. 102 Union Oil Co., Bakersville, Calif.	12.9	280
V	No. 18 Union Oil Co., Bakersville, Calif.	12.9	285
W	Toltec Or Panuco Oil, Inter Ocean Oil Co., N. Y.	12.0	134
X	Toltec Fuel Oil, Inter Ocean Oil Co., N. Y.	11.7	220
Y	Inter Ocean Oil Co., High Flash Heavy Crude	10.86	180
Z	Mexican Residue	10.0	374

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Multiwhirl cooler designed for the exchange of heat between two fluids. Internal construction is clearly shown.

turn tubular ideas of a decade ago to the numerous patented devices on the market today is interesting in the extreme. Essentially the effort has been throughout to improve upon the rate of heat transfer. With this end in view the film type of heater which brings the steam in contact with one or both sides of the oil piping, the endless coil heater and the multi-pass type are striking examples. It is evident that the greater the area of heating surface within reasonable limits of container size, and the more thorough the mixing of the oil particles, the more efficient heating will be obtained with the least amount of steam. Either live or exhaust steam can be used in a fuel oil heater. Where lower temperatures only, are necessary, it will usually be possible to use exhaust steam from the oil pumps. When heavier oils are used, however, requiring heating above about 200 deg. F. it will be best to use live steam.

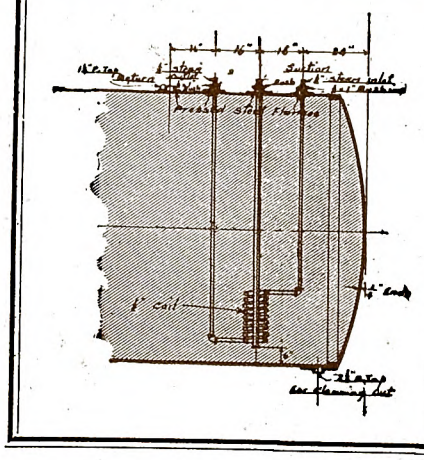
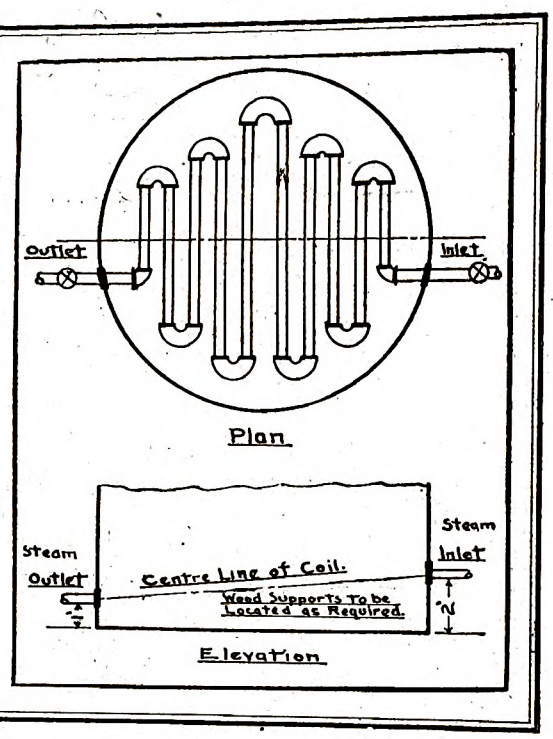
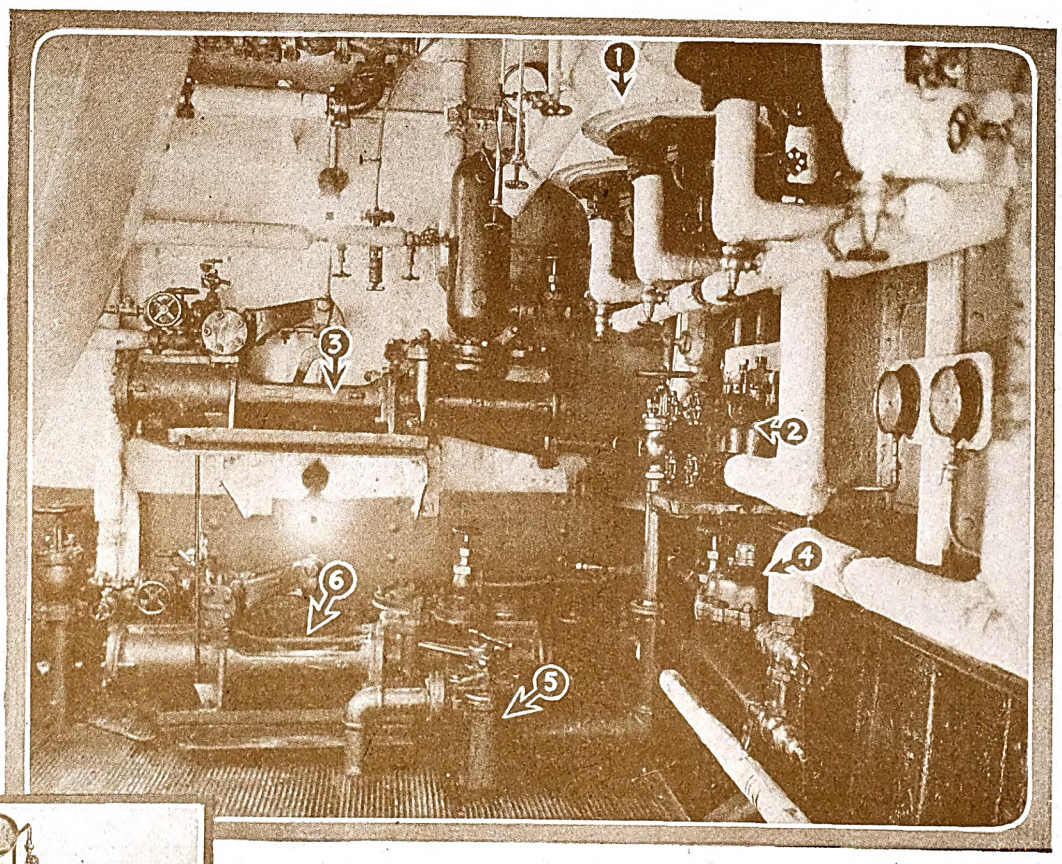


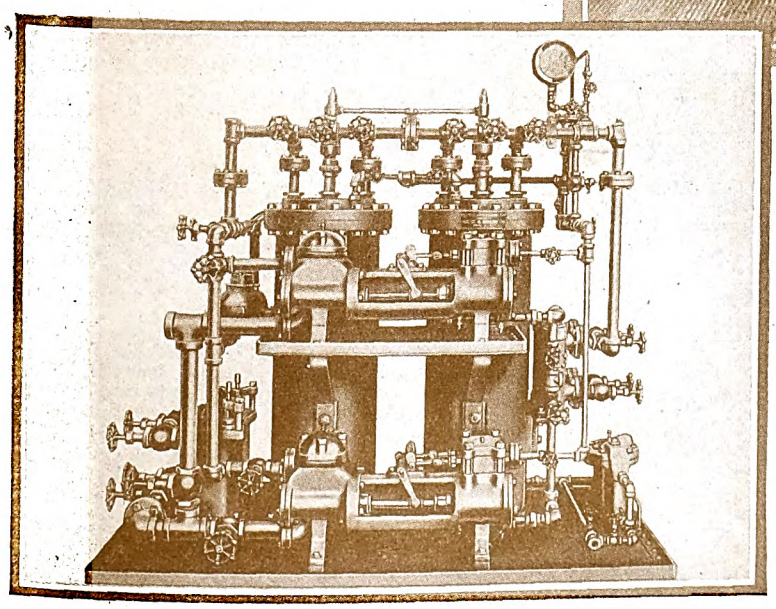
Illustration of the method of heating fuel oil at the suction inlet in a horizontal oil storage tank. In this arrangement a small steam coil is placed in the storage tank surrounding the inlet to the suction pipe.



Diagrammatic sketch of a steam heating coil arrangement for installation in the base of a vertical fuel oil storage tank.



Installation of coil type oil heaters on board S. S. Paul Luckenbach. 1—Oil Heaters, 2—Discharge Strainer, 3—Service Pump, 4—Meter, 5—Suction Strainer, 6—Service Pump.



Oil heating, pumping and straining outfit complete with connections, valves, and gage, etc.

The primary purpose of a fuel oil heater is to reduce, to a varied extent, the sluggish condition that the oil may be in, due, if a heavy crude, to its naturally high viscosity and low Baumé gravity; or, if a residual fuel oil, to either a high viscosity or to cold weather, or both combined. Whatever the cause of such a sluggish condition, it nevertheless must be reduced in order that the oil may be enabled to flow normally freely, with fair rapidity, as little pulsation as possible and without clots, etc. Thus only will we insure a constant stream to the burners, and hence continuous atomization, all other factors being properly conditioned. This result can only be obtained by the application of heat to the oil. This latter should not be applied, however, to such an extent as to render operating conditions dangerous, but only in sufficient amount to reduce the viscosity and attain the desired flow. In best practice this heat is applied by means of steam coils, located in the main fuel oil storage tank, or by some form of standard fuel

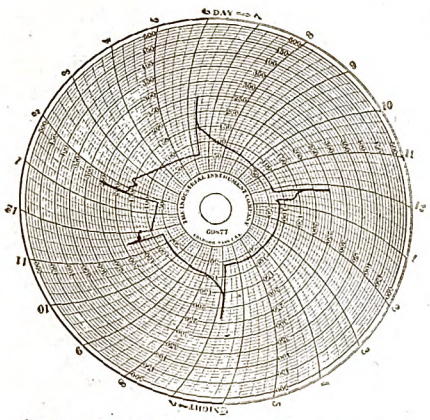
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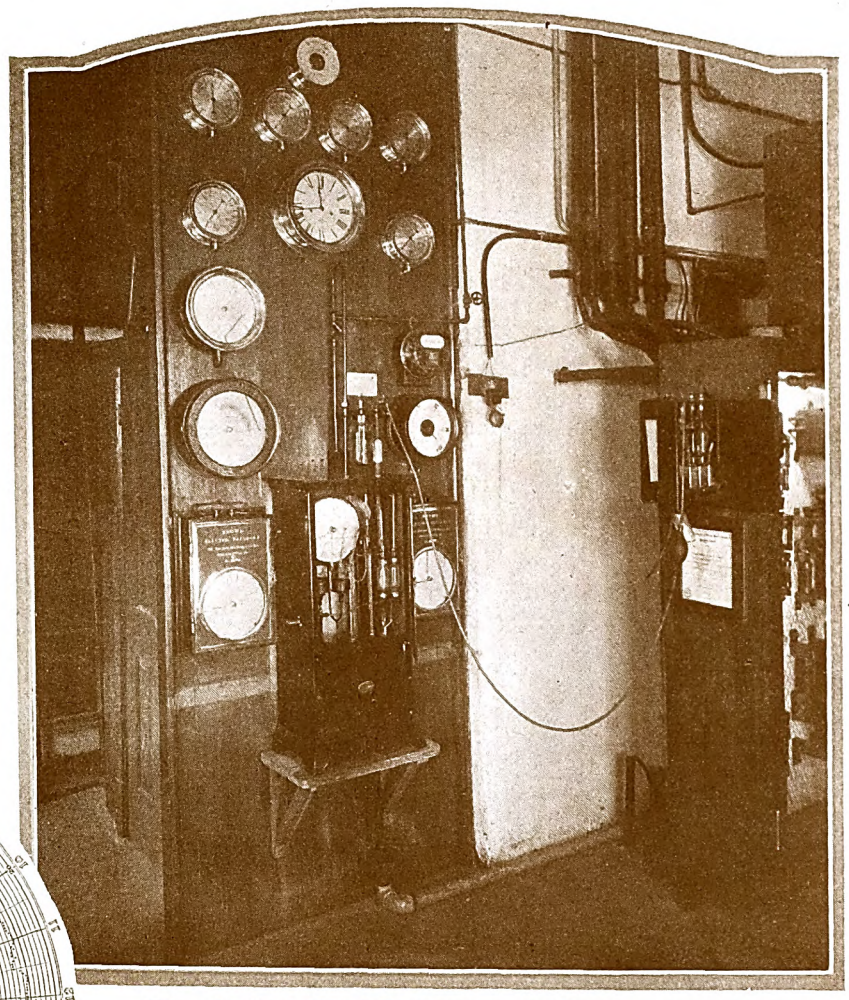
Stopping the Biggest Power Losses

Practical Combustion Suggestions for the Average Plant

By James T. Beard, 2nd



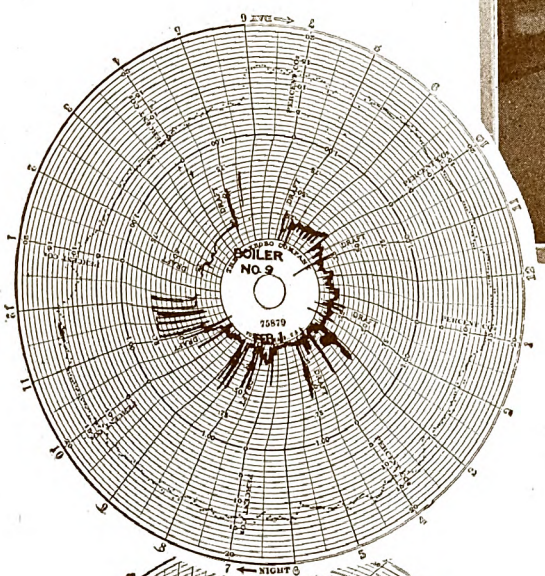
Record obtained with recording thermometer with bulb located in blow-down line of the boiler. This method is often used to check the number of times the boilers are blown down every day. Opening the blow-off valve increases the temperatures, in the line and registers on the chart. In this case there were five blow-down periods.



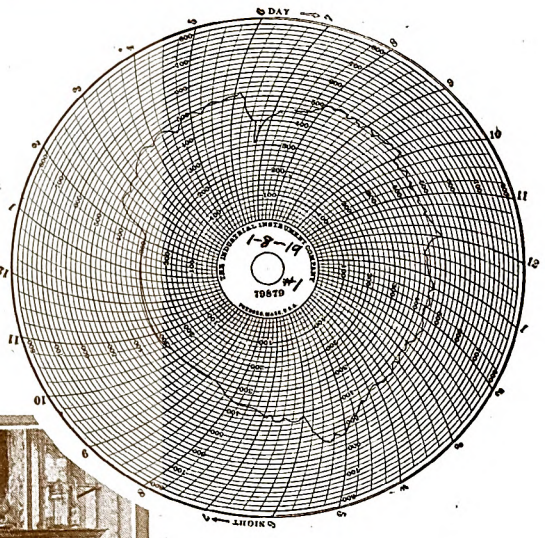
HAVE you ever seen the chief walk down the firing floor, pull open a door here and there, look into the furnace, using his hand to shield his eyes from the glare, and remark, "That's a good fire"? From years of experience he has trained his eye to detect spots in the fuel bed and, as a rule, he is a good judge of combustion efficiency, basing his conclusions solely upon his personal observations.

In boiler house operation, however, there are many little leaks, heat losses we call them, which cannot be observed by a casual inspection of the fires. Such losses are not spotted until the superintendent calls the

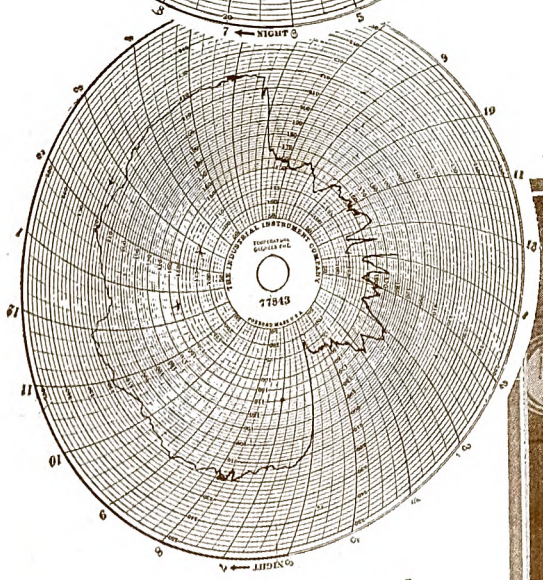
At the left—A typical instrument board in a small boiler plant, furnishing continuous records of plant operation and economy. With such equipment it is always possible to detect the sources of loss and to take proper steps to stop them. These intruments also warn the chief the instant that his heat units are getting beyond his control.



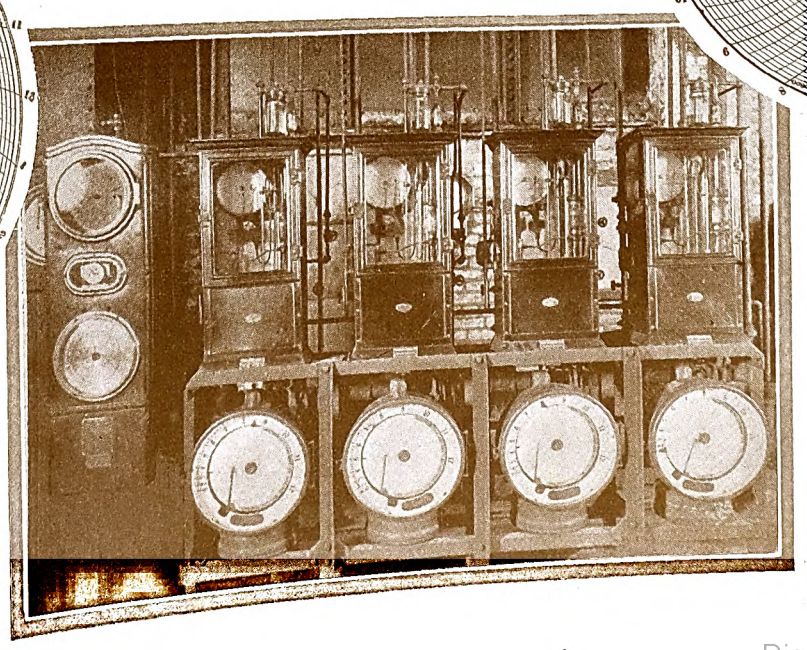
The chart at the left shows a continuous record of the percentage of CO_2 giving an indication of the amount of excess air, in the flue gases leaving the boiler. CO_2 recorders similar to this are among the most valuable instruments in the boiler house for detecting heat losses. The chart shows that the fires were banked from midnight until 6 a. m.



At the right—Sample of chart showing temperature record of flue gases leaving the boiler. These gases should not greatly exceed 550 deg. F. During the night when the fires are banked the temperature is correspondingly low.

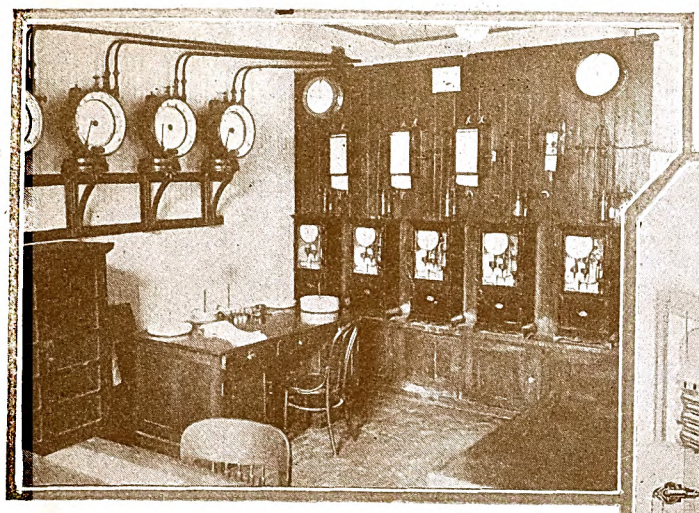


Feed water thermometers — although not properly classed as combustion appliances—are valuable in indicating the cleanliness of feed water heaters and their efficiency of heat transfer.

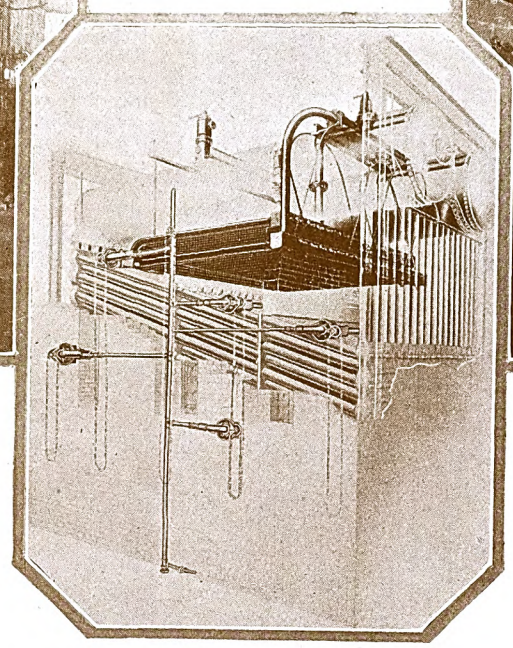


A battery of instruments for what is evidently a 4-boiler installation. In this case each boiler is provided with a separate CO_2 recorder and a separate steam flow meter, indicating the combustion efficiency and the capacity developed by each individual unit.

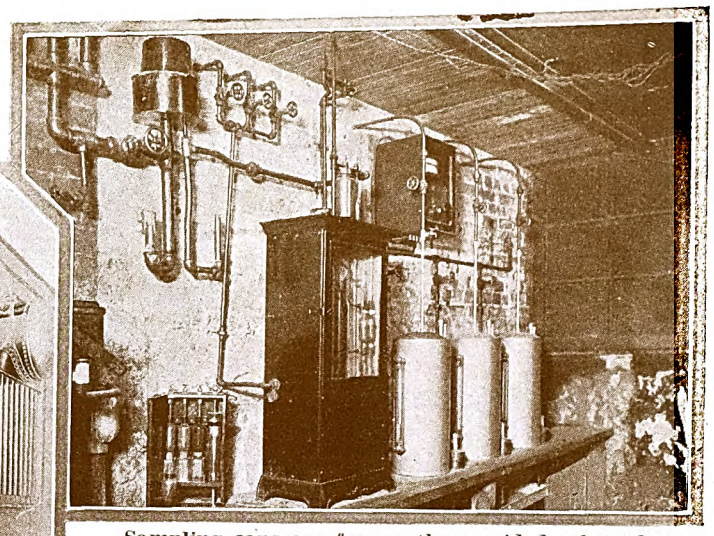
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This complete instrument equipment in the office of the chief engineer makes his private sanctum resemble the pilot house of a ship and provides him with instant and continuous information that enables him to guide his plant along a safe and economical course. The instruments include steam flow meters, CO_2 recorders, flue gas pyrometers, feed water thermometers and a hand orsat for periodically checking the accuracy of the CO_2 recorder. Note the charts filed on convenient pegs on the chief's desk. These instruments accomplished a saving of 2,000 tons of coal a year in this plant.



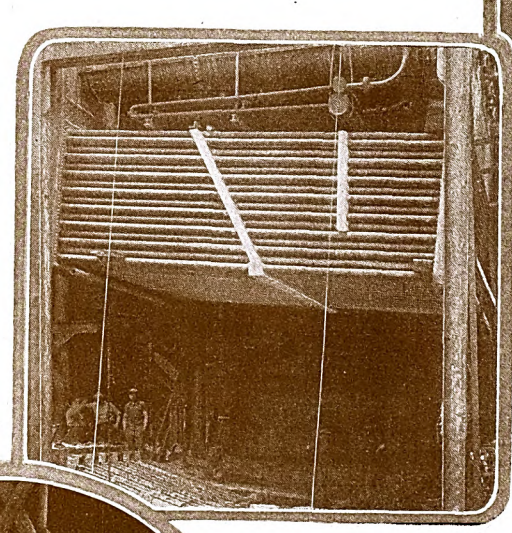
Phantom view of a boiler and setting, showing the location of permanently installed soot blowers. Such appliances are essential for scouring the soot deposits from the external surfaces, thereby increasing the capacity of the boiler.



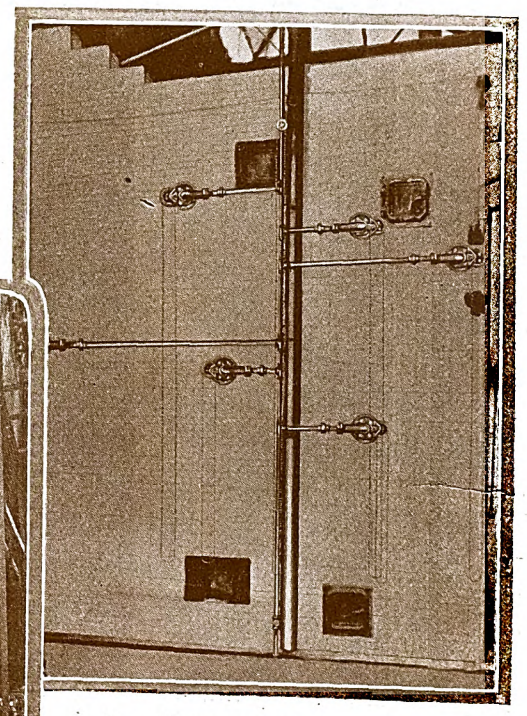
Sampling cans are frequently provided, when the cost of individual CO_2 recorders for each boiler is prohibitive. These cans collect average gas samples over a period of time and, when used in conjunction with a CO_2 recorder in the main flue afford valuable information on average daily operations. The collected gas samples are tested daily with a hand orsat in a few minutes and the figures recorded for each boiler.

chief into the office at the end of the month to explain why the coal record showed a big jump last month. And the chief is at a loss to explain. Perhaps he puts the blame on a poor run of coal, faulty grates, leaky baffles, poor draft control. But he has no knowledge, based upon records, that enables him to put his finger on the weak spot and say, "There's the trouble, and as long as you insist on buying 22-per cent. ash coal, we are going to have the same trouble."

Compare this chief with his brother who sits at his desk, from which he directs the operation of a similar power plant. Records for the previous 24 hours of operation are placed before him and he

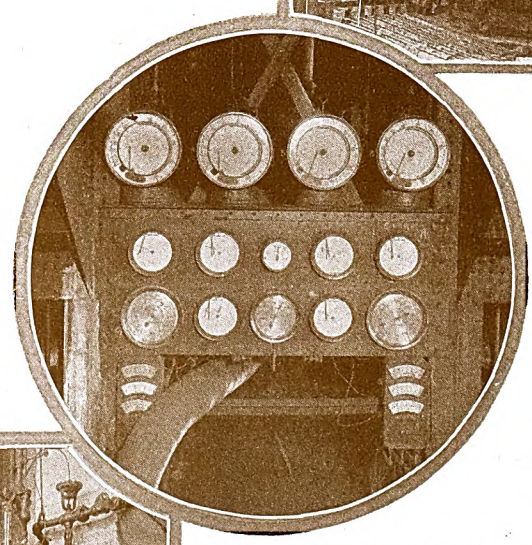


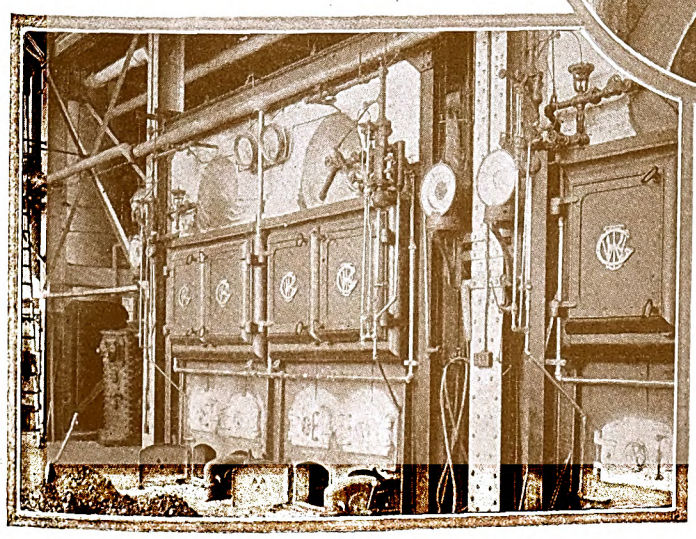
How baffles are located in some types of water tube boilers for the purpose of deflecting the gases across the tube banks 3 or 4 times before they leave the boiler. The short-circuiting of hot furnace gases through cracks and leaky baffles is one source of heat loss and high flue gas temperature, which must be avoided.



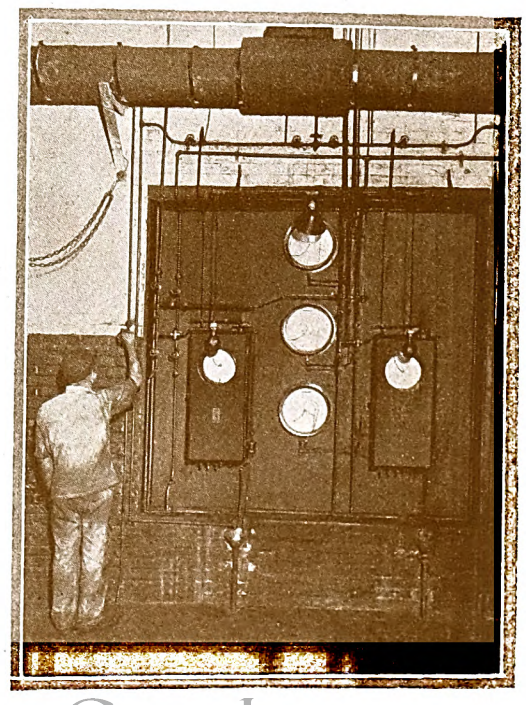
Soot blowers as they appear from the outside of the boiler setting. Steam is turned into the blower unit while it is slowly revolved by pulling the continuous chains. Soot and slag deposits are thus scoured from the tube surfaces.

Even in small hand-fired plants it has been found profitable to install individual flow meters on each boiler, at the same time keeping careful records of the amount and quality of coal burned. Surprising economies have often been effected by this small outlay.





Above—A battery of flow meters, thermometers and indicating draft gages in a large industrial plant boiler house. Because of the resemblance to other boiler house instruments, indicating draft gages have in some cases been very successful in winning the appreciation of the boiler room force



At the right—A compact type of CO_2 recorder which also affords accurate and continuous records, indicating the amount of excess air and preventable waste in the flue gases. The fireman is in the act of opening the gas sample line to one of the boilers.

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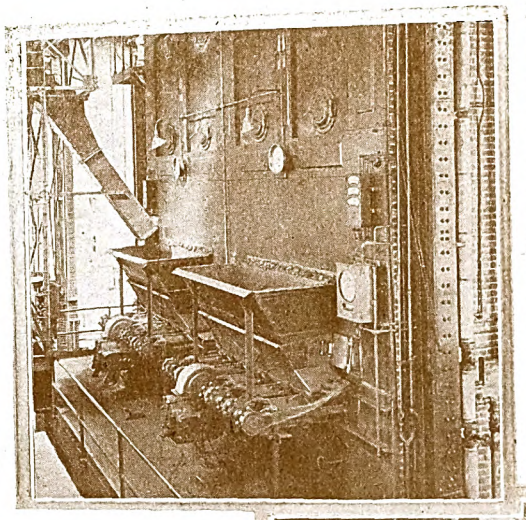
studies them closely. "Looks like that front baffle in No. 3 has broken through," we hear him remark. "That's a job for this Sunday. Guess I'll have to get Pete to coach that green fireman on No. 5; he don't seem to get the hang of it, judging from his charts for the past few days."

At the end of the month he, too, is called in to the superintendent's office. "How's this, Bill?" the big boss says. "I've got you down for 1,800 tons of coal last month. That's a jump of 350 tons of coal over the month before."

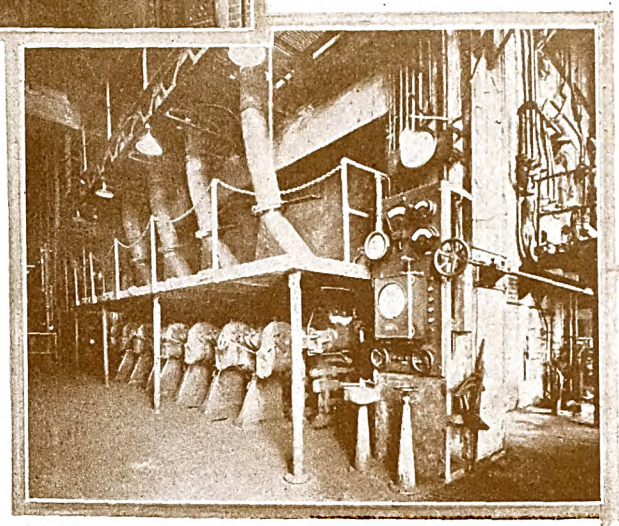
Bill smiles. "I expected to be called up here on that. Well, here's the story. You've been running them soap kettles night and day this past month and our records show that we have made five million pounds more steam this month than last. I don't want to bother you with all the figures I've got, but, when you figure it out, they show that we have knocked off a little better than 69 per cent. efficiency in the boiler house, which is even better than last month. But that is natural, because we had a little better run of coal."

"Guess you're right, Bill," says the superintendent, "but you better let me have those figures for the manager, when he comes down tomorrow.

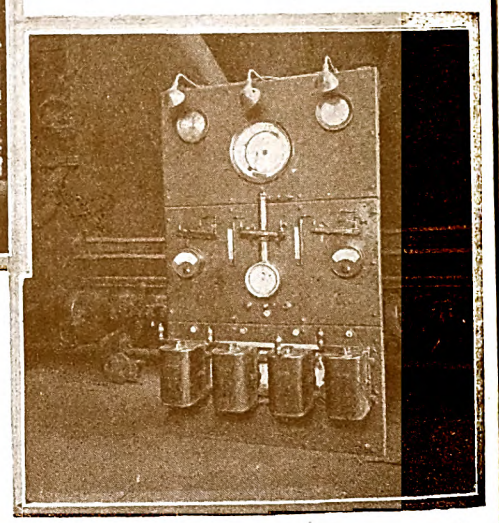
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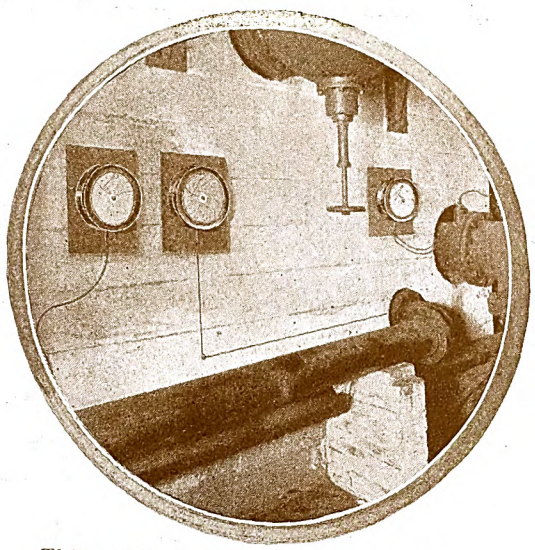
When flow meters and draft gages are mounted upon the boiler front in plain view from the firing floor, their usefulness is greatly increased, as compared with locating them in the engine room or at some distant spot. Stokers, as a general rule, are capable of greater average continuous efficiencies, particularly at considerable overloads, than hand-fired grates, due to better fuel distribution. Even in stoker installations, however, instruments are valuable in maintaining the operating economy which is possible with that equipment.



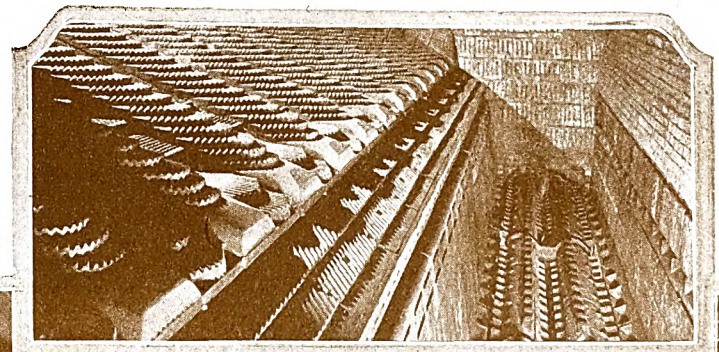
Another stoker installation with instruments and control conveniently located within easy view and access of the attendant. Convenience is a big factor in economical boiler house operation. You cannot expect a fireman to go too far out of his way to save coal, whereas he might stretch a point to hold steam.



Modern installations have recognized not only the value of complete instruments for guiding boiler room operatives, but have grouped them with their proper damper, blower and stoker controls so that the latter may be quickly and easily adjusted to meet variable load conditons.

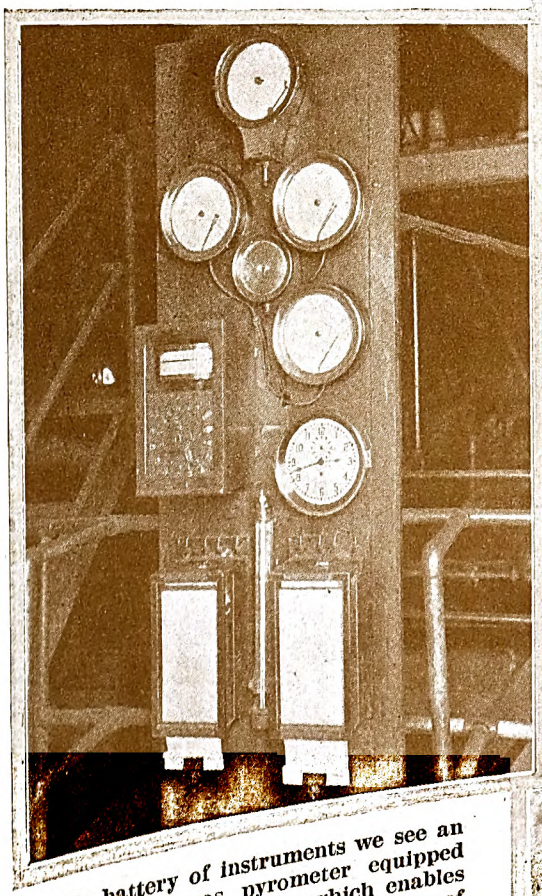


This picture shows how recording thermometers are connected to feed water lines providing a continuous record of fluctuation and losses of heat in the water entering the boilers. In this case it would seem at a glance that proper insulation would save many units of heat now going to waste by radiation.

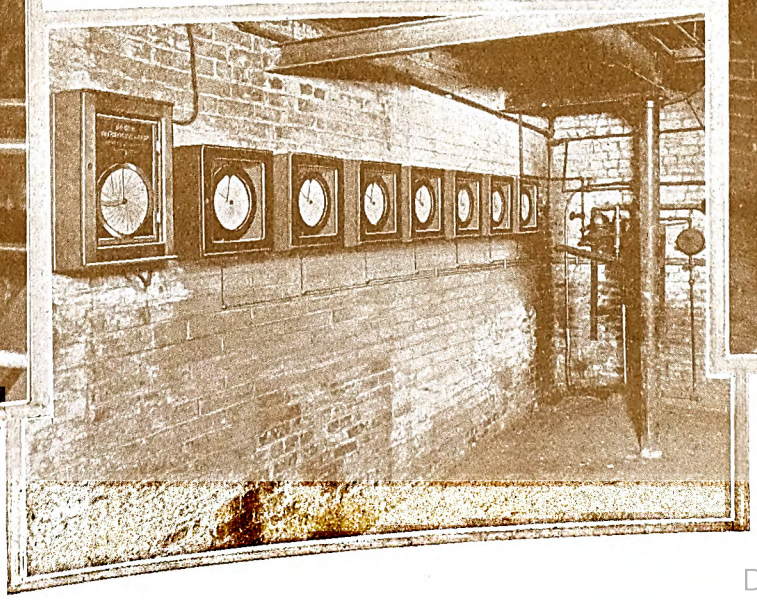


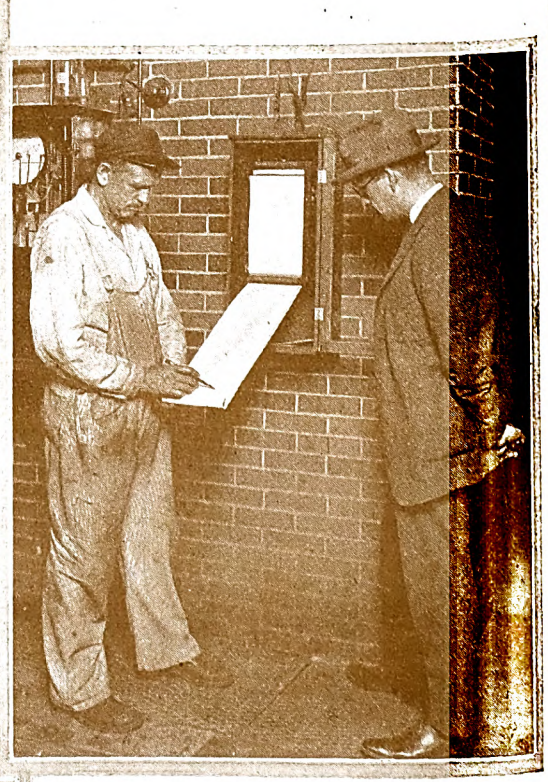
View of the interior of the furnace under a large water tube boiler, showing the retorts and tuyere plates of a multiple retort type of stoker. Replacing burned out tuyere plates is an item of expense in some plants that is due largely to unintelligent combustion control and lack of proper instruments

Below—A battery of thermometers and an electrical pyrometer ticking off the record in a corner of the boiler house. Note the automatic damper regulator for controlling the draft and the combustion rate in the furnaces.



In this battery of instruments we see an electrical flue gas pyrometer equipped with a multi-point switch which enables one instrument to serve a number of by throwing the switch to the proper contact.





Here we see the chief writing down the reason for the big jump in flue gas temperature when a couple of bricks dropped out of the front baffle in No. 1 boiler. That means a job for next Sunday to get things ship-shape.

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Where Do We Stand?

Julius H. Barnes Analyzes America's Industrial Development, and What It Portends for the Future

WITH all the various "blocs" and propagandists for this, that, and the other, each one vociferously promoting its pet ideas, it becomes increasingly difficult to separate news from propaganda; and well-nigh impossible for the average busy man to form an accurate idea of world events.

At the same time, if we are to plan ahead intelligently, we must first know something of the factors with which we have to contend. Is our industrial expansion at a peak, and due to recede, or is it in a state of healthy, continuous growth? Is the present chaos in Europe to continue indefinitely, or is normalcy in sight there, as here? Are we to forget, for years to come, the possibility of developing foreign markets for our products, or are conditions so adjusting themselves that our foreign trade will shortly be a calculable factor? These are some of the questions which the late war brought into being; questions the Versailles Treaty and subsequent political events have complicated, rather than solved. And it is with a view to answering these questions and in general giving a clearer perspective of this country's situation in relation to the rest of the world, that we present the following analysis—a composite of the written and spoken conclusions of the President of the United States Chamber of Commerce, Mr. Julius H. Barnes. These conclusions are based upon the well-reasoned analysis of a man particularly fitted for the task, and who has made the most of his exceptional opportunities for first-hand study of existing conditions both here and abroad.

* * * * *

TODAY, the most common standard of comparison is the "pre-war" year of 1913. It is true that the disorganization of war and of the

(*Continued on page 64*)



Julius H. Barnes, President of the United States Chamber of Commerce, who returned recently from Rome—where he headed the American Delegation at the meeting of the International Chamber of Commerce. Mr. Barnes combines a deep study of industrial and business conditions with an exceptional faculty for sane and logical analysis; making his conclusions, as presented in the accompanying text, of very real value to the men who direct American Industry.

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Handling Parts and Packages

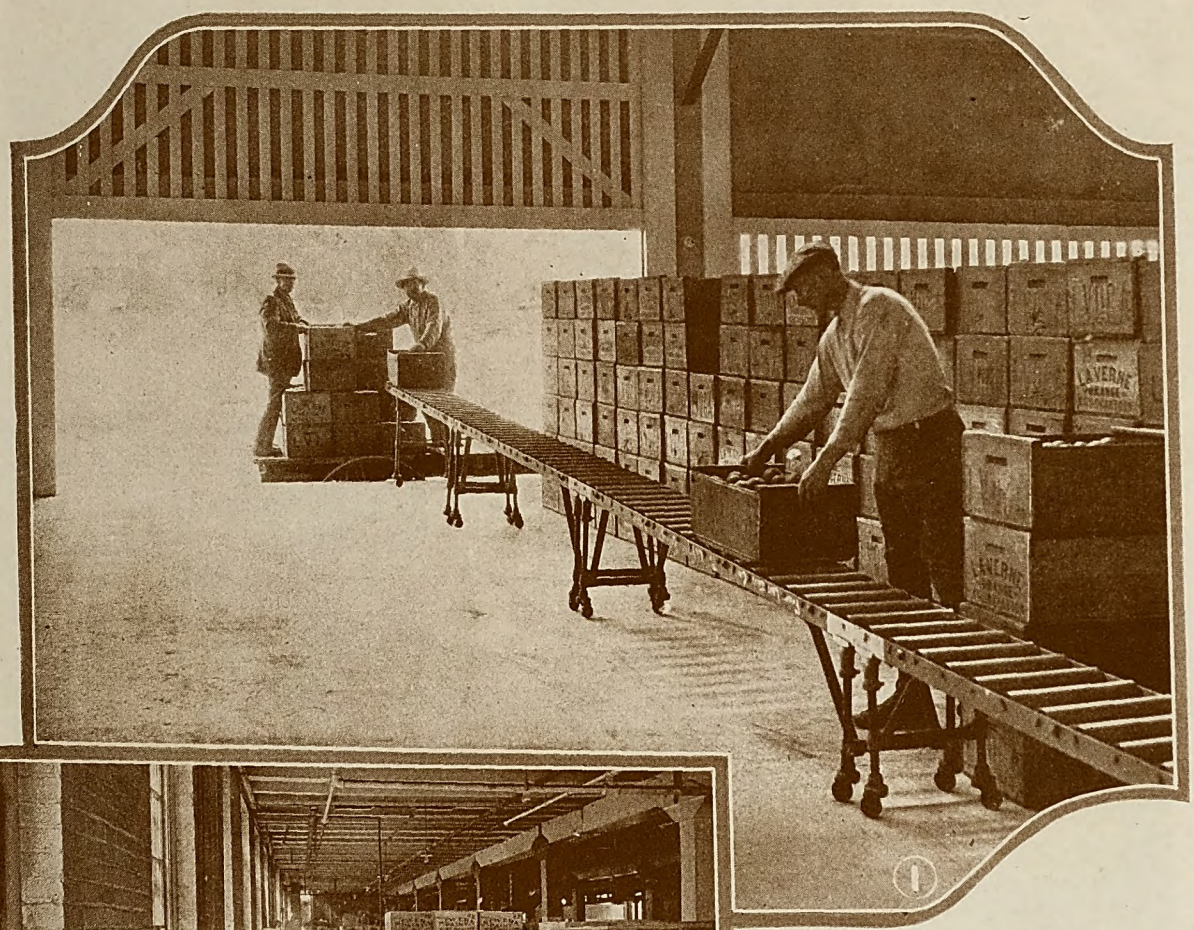
Equipment That Makes Production Run Like Clock Work

By Matthew W. Potts

THE handling of assorted commodities at first appears to be a very difficult problem, but there are many types of materials handling equipment that will handle anything from fragile glass to heavy castings. It is not necessary to pay so much attention to the type used, as it is necessary to pay attention to the construction of the equipment so that it will give a definite service.

To illustrate this point, we will consider the gravity conveyor shown in figure 15, which is of light construction. This conveyor would not be adaptable to the operation of handling heavy castings, as shown in figure 16, because the roller construction is too light, and the heavy castings would quickly damage the conveyor. Therefore, the first point in selecting equipment, is to see that it is properly built for the service required.

It has also been a theory among engineers, that when installing this class of equipment, one type should be used throughout. It will be noted by the illustrations that in practically every installation,



A straight run portable gravity conveyor reduces handling costs on many unloading operations.



The Push Bar elevator shown below carries packed boxes from the nailing machine to a gravity conveyor suspended from the ceiling, which carries them to the shipping department.



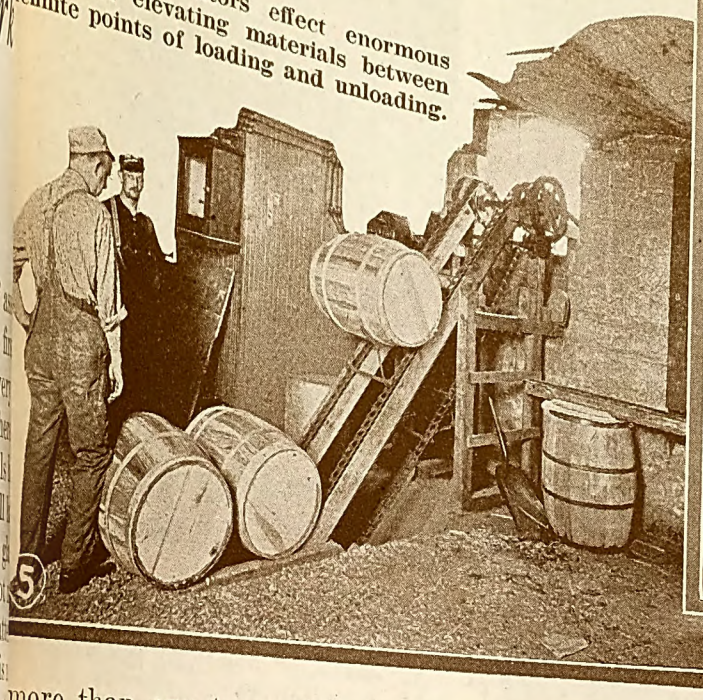
Co-ordination of various types of equipment is real materials handling.

Flat belt conveyor handling assorted commodities in delivery room of a department store.



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Simple arm elevators effect enormous savings in elevating materials between definite points of loading and unloading.



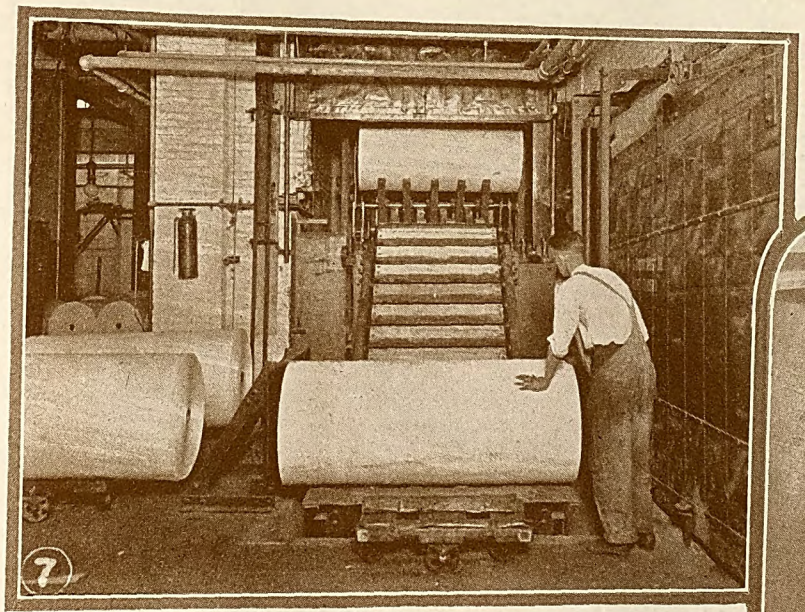


Tray elevators can be designed to handle various shaped packages. The same tray will frequently carry both barrels and sacks.

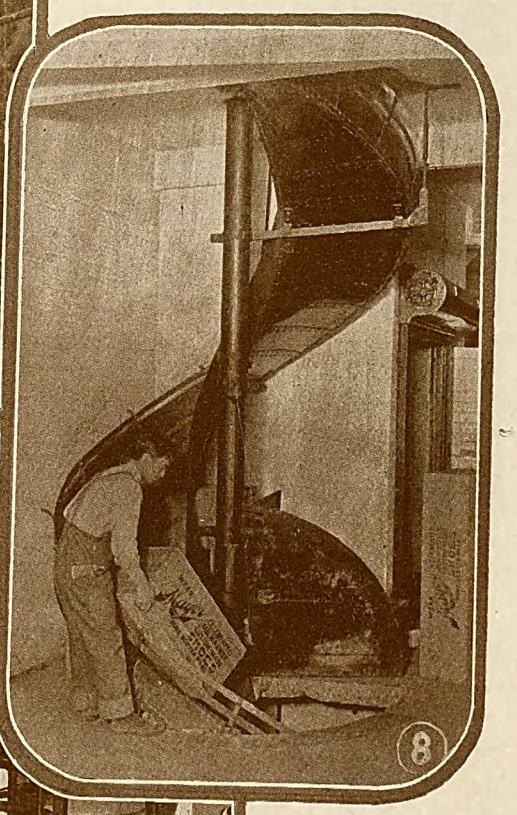
more than one type of equipment is used. For instance, figure 2 shows short sections of portable gravity conveyor, feeding to a slat conveyor, which carries the material the full length of the storeroom. At the end of the slat conveyor is a short section of gravity roller conveyor, which acts as a feeder to the push bar elevator which carries the material to the shipping room.

This installation shows good co-ordination of three types of materials handling equipment on one operation.

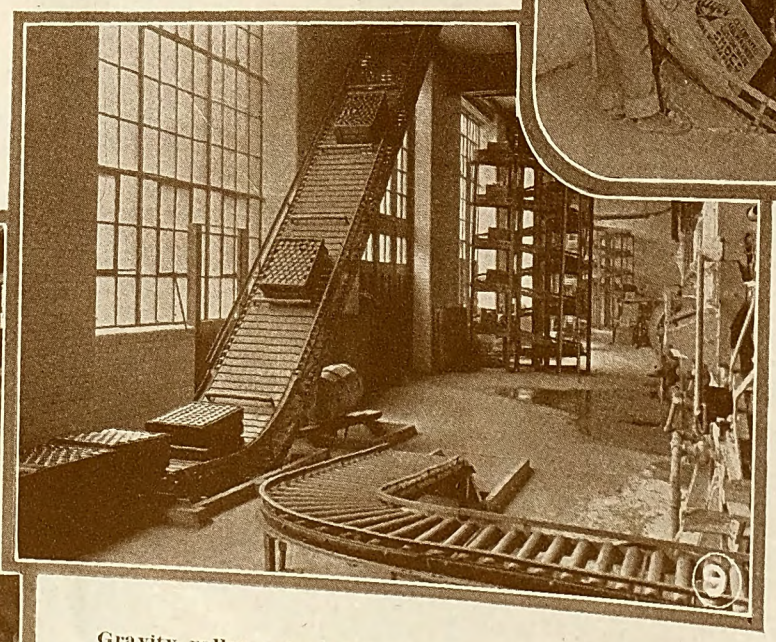
Each type of equipment shown can be used in various industries, and under different operating conditions. For instance, flat belt conveyors. Note how they are used for loading trucks, for handling bundles of loose clothes in laundries, conveying papers for handling packages in department store delivery room, as well as in the manufacture of chocolate bars, and tinware utensils. This is a wide range



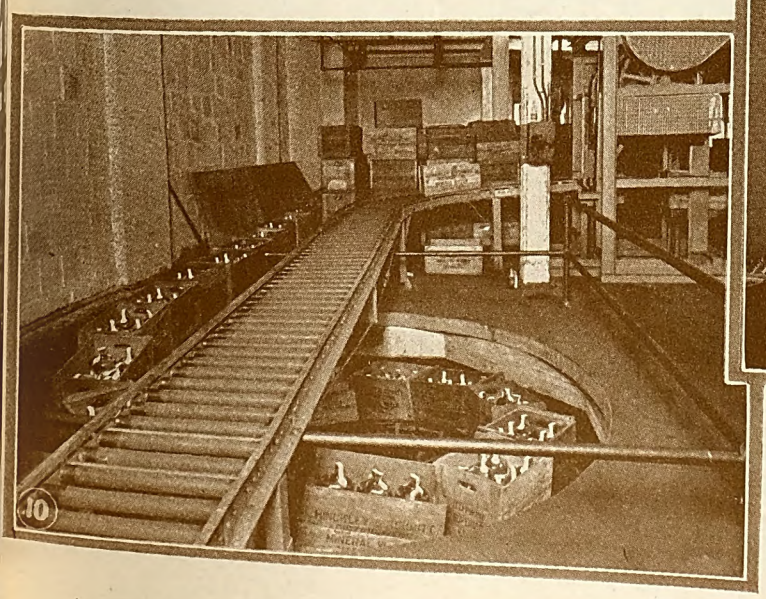
The weight of the package carried by tray or arm elevators, determines the size of chain and detail of finger construction. The one here shown handles rolls of paper, having any length from 32″ to 68″, and weighing from 900 to 1,800 pounds. The slat conveyor feeder is of special design.



Spiral chutes should be provided with fire doors at all floor openings. This photograph also illustrates the proper method of loading cases at intermediate floors.

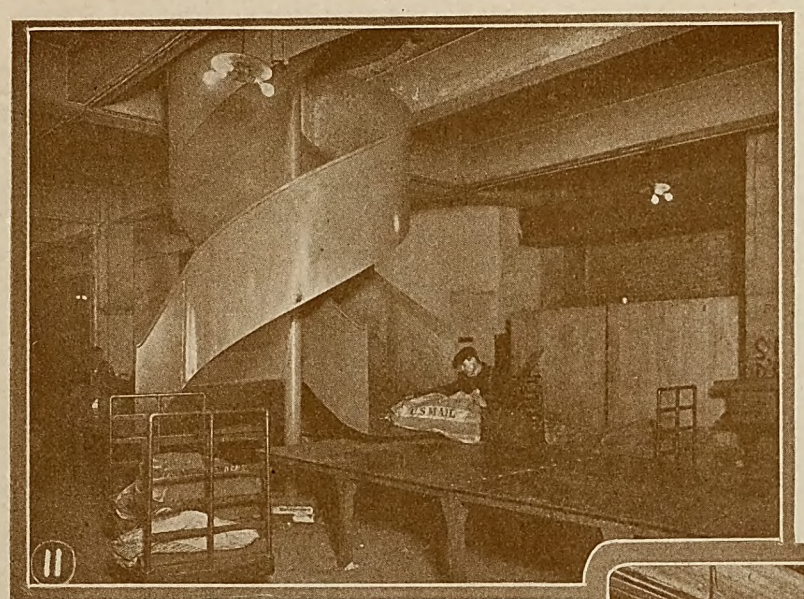


Bottling factories are extensive users of gravity roller conveyors, and gravity roller spiral chutes. The elevator is a slat conveyor fitted with push bars, carrying the load instead of sliding it on the metal surface.

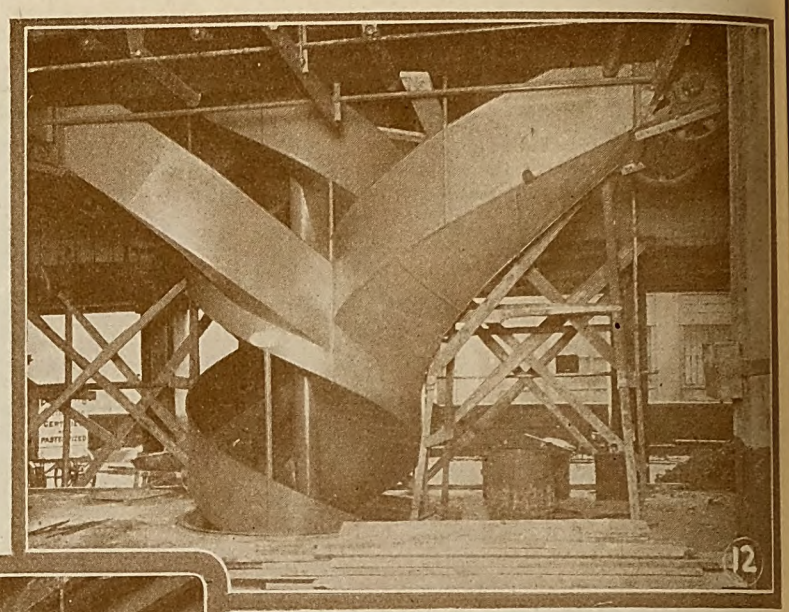


Gravity roller spiral chutes require full circular openings in the floor, which are more difficult to equip with fire doors than common spiral chutes. To the right is a suspended tray elevator, which elevates the cases and feeds them to the gravity conveyor, which runs over the spiral chute.

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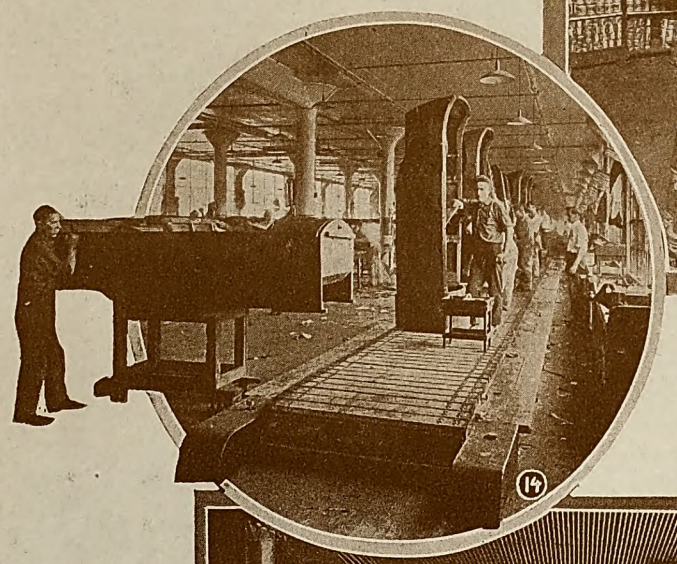
Double blade spiral chutes can be built around one post and pass through one floor opening. This shows the discharge of such a chute.



While spiral chutes are generally simple in design, the above double blade chute is more or less complicated, because of receiving materials direct from three belt conveyors.

Apron conveyors greatly assist in progressive assembly work; some carry the materials while the man stands still, and works in a limited space, others carry both the materials and the men. This illustrates the method of loading and working on the conveyor.



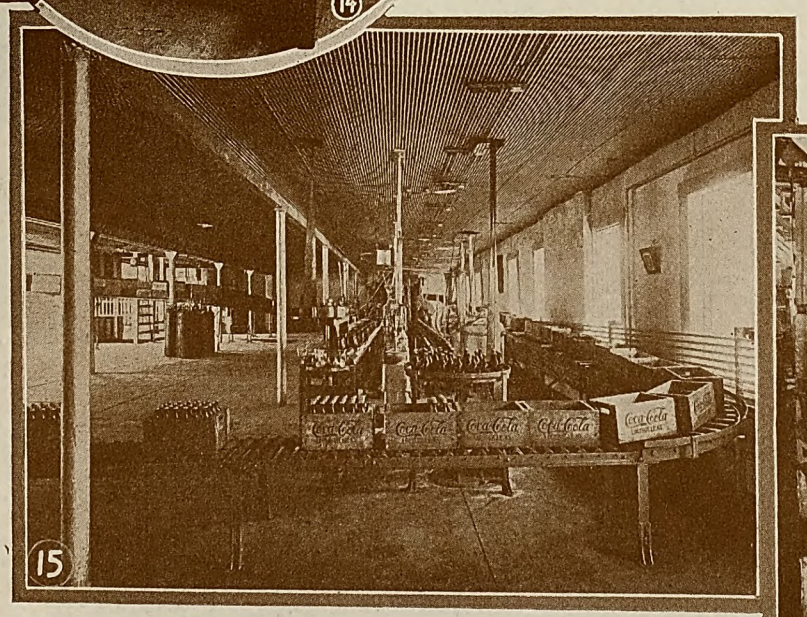


Many industrial plants have found it economical to install spiral chutes. The above shows how small packages hug the outer guide rail. This same chute can handle large cases say 24″ by 14″ by 30″.

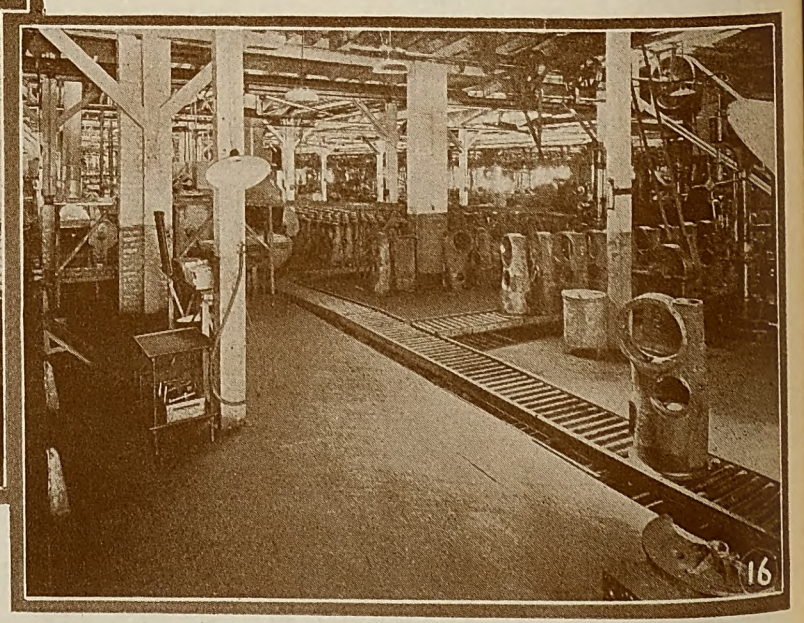
of adaptability for one type of equipment, but it is typical of what can be done with practically all types. Frequently the same operations which are shown being performed by flat belt conveyors, can, under modified working conditions, be done just as efficiently by slat conveyors or gravity roller conveyors.

The various types of equipment shown require power to operate them, except in the case of gravity roller conveyors, and gravity spiral chutes. These conveyors, which use the natural force of gravity, are by far the cheaper operating units.

A typical installation is shown in figure 1, for unloading wagons and trucks. The section of conveyor being mounted on rollers or casters, permits it to be moved from



Bottling works are extensive users of gravity conveyors. This is an efficient method of bringing empty cases to the bottling machine and taking the filled cases to the shipping room.

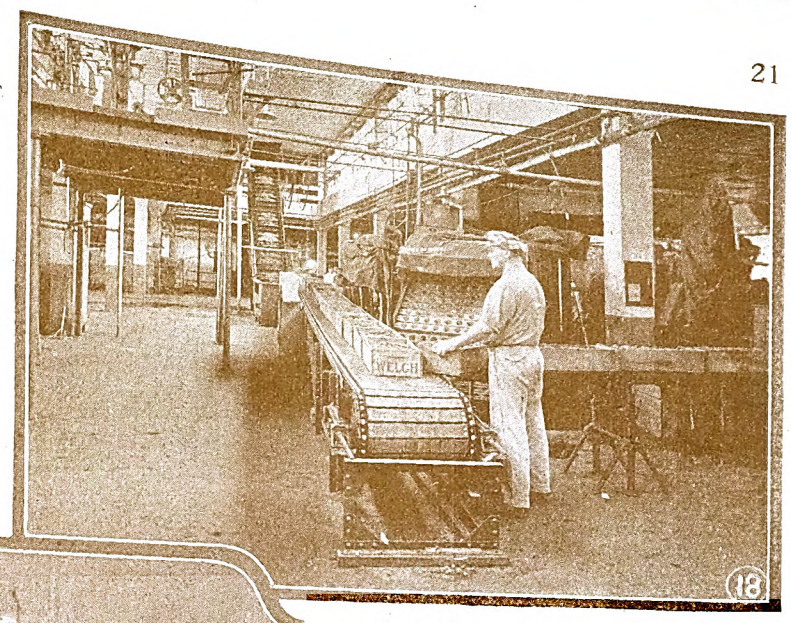


Gravity conveyors also fit into many machine shop operations, co-ordinating and speeding up the work. Care should be taken to stipulate what the conveyor is to be used for, when purchasing.

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Arrangement of portable gravity roller conveyor with slat conveyor for unloading crates of sheet tin from freight car. A hand operated mechanism provides for the lowering of the crate from the end of the gravity roller conveyor to the slat conveyor.

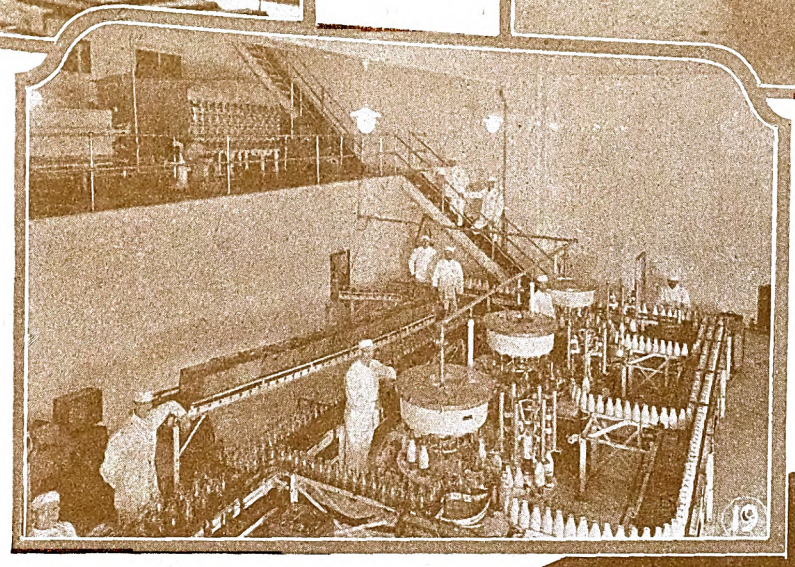


No one type of conveyor can perform all operations. This view shows a gravity roller conveyor, slat conveyor and special conveyor for the handling and washing of grapes.

one part of the building to another, without serious loss of time.

On long runs of gravity conveyor, where a fairly steep gradient is required, it is often necessary to provide boosters, or push bar elevators to raise the material sufficiently for it to continue to travel by gravity.

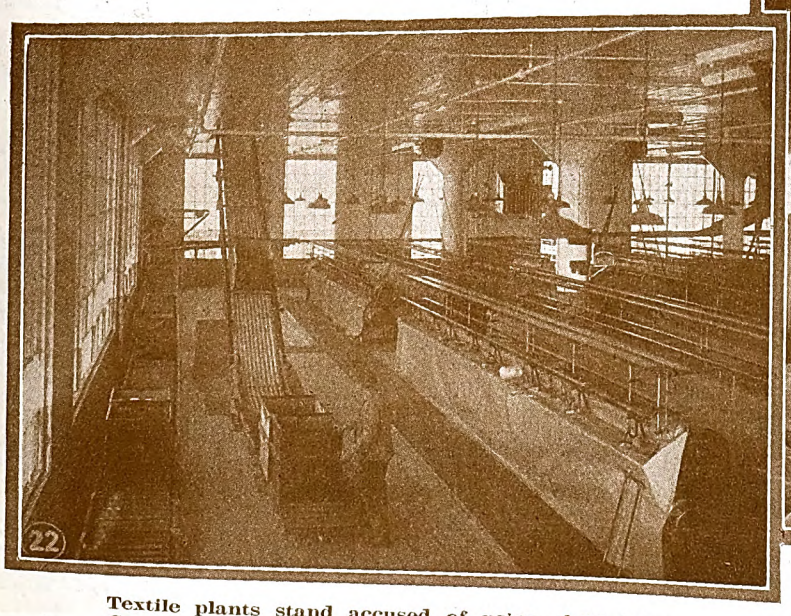
Where the operation is predetermined, and equipment definitely located, as in figure 15, the gravity conveyor is very advantageous, because it can be used for a storage rack, as well as a conveying medium. In this installation, the boxes are received at the far end of the room, filled with empty bottles. These bottles are removed and fed to the filling machines, and the empty boxes are placed on the gravity conveyor, which



Looking at this installation, one can realize the amount of floor space saved by the use of conveyors. Think of doing this volume of work by hand methods!



Apron conveyor acting as an elevator, for rasing heavy buckets of paint from basement storage to railroad cars.

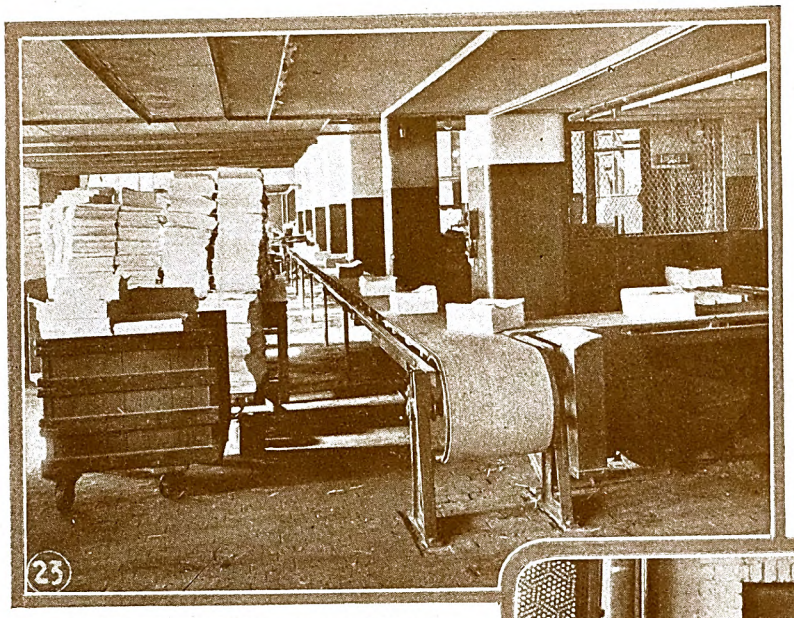


Textile plants stand accused of using child labor. Conveyors are now being found cheaper and more efficient.



The apron surfaces of conveyors can be built of such a nature as to adapt themselves to the type of package to be handled. The above is giving good service in transferring barrels of sugar from the refinery to warehouse.

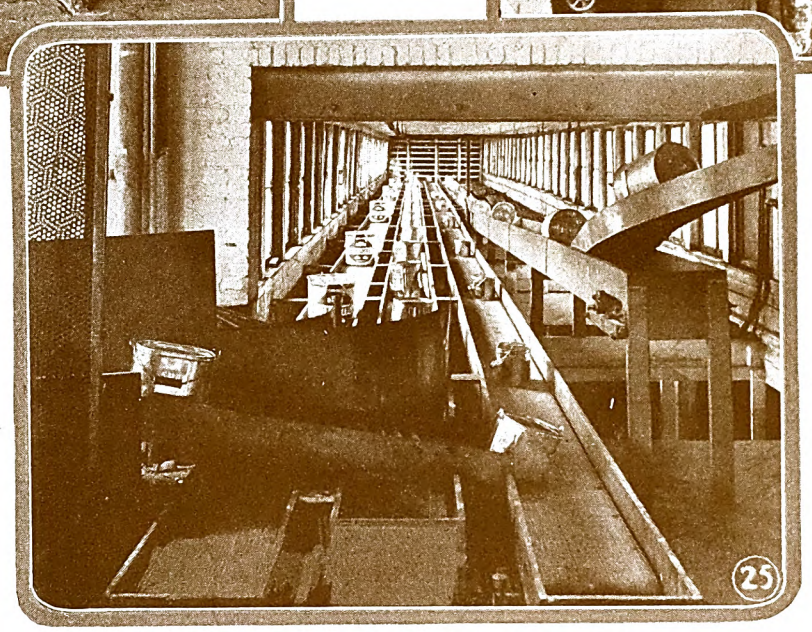
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Flat belts handle many different types of packages. This shows the method of discharging from one belt to another at right angles.

carries them to the point shown. As filled bottles are received from the filling machine, they are immediately put into the cases and moved forward to the storage room or shipping department, thus avoiding congestion. Where thousands of bottles are handled per day, as in this case, it would be difficult to obtain efficient operation with old hand truck methods.

Machine shops and automotive industries have found gravity conveyors of wonderful assistance in moving materials from one operation to another. Figure 16 shows heavy castings moving under their own power between various machine operations. The



After tinware is inspected, it is placed on the belt which carries it to the shipping room; at right angles to the belt shown, and along the far wall, the other conveyors which discharge to flat belt conveyors carrying the finished product to the shipping room.



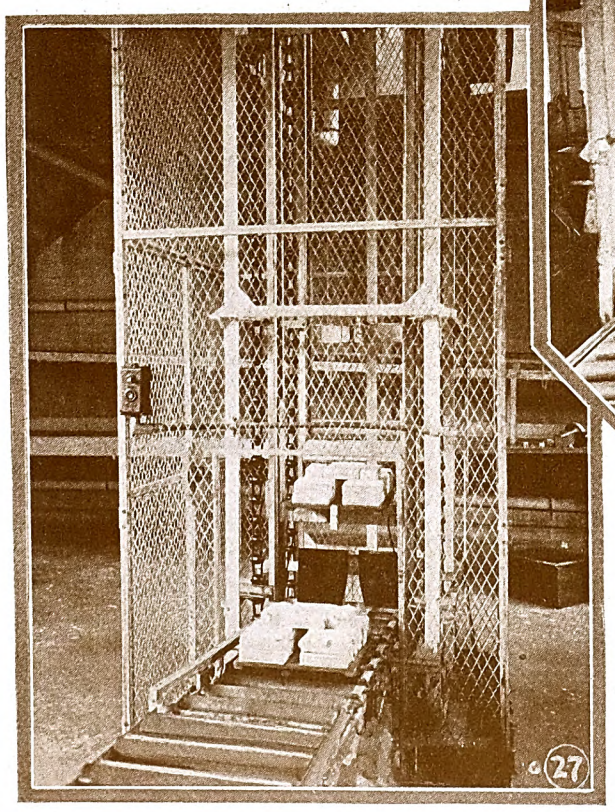
gradient in this operation is very slight, as the castings are so heavy that they move forward very easily.

When desiring to take a casting from the main run conveyor to the first run shown at right angles, it is necessary for a man to guide them at this point. When, however, they proceed directly to the second right angle run, they convey themselves without attention around the 90° curve. Such an installation invariably speeds up production, and eliminates idle productive equipment due to lack of material being on hand when required.

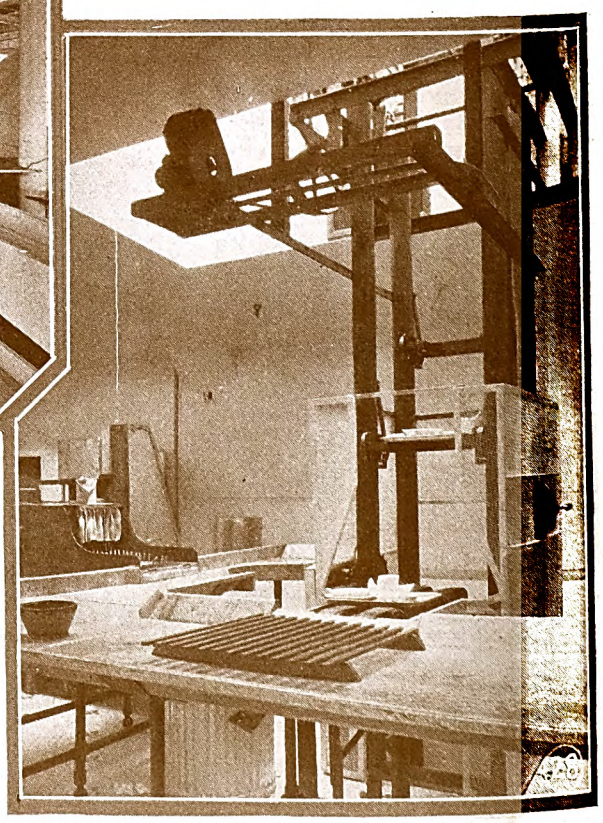
An ideal installation, in any type of plant, is compact, and the use of conveyors frequently saves thousands of square feet of floor space that would be required if hand methods



Large laundrys are eliminating hand truck methods, and coming to the more extensive use of conveyors.



When elevators are installed in the center of a room, they should be fully protected by safety guards.



Tray elevators are being installed in restaurants to carry trays of dishes from the main dining room to the washers. While this is not a productive operation, it is a matter of service.

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Flat belt conveyors fitted with cleats, can be used as elevators between floors. This one is used for carrying chocolate bars to wrapping machines.

were employed. Figure 19 shows the modern method of bottling milk: an installation that has three runs of slat conveyor, and one run of gravity conveyor. By mounting angle guides above the carrying surface of the slat conveyor, it is a simple matter automatically to feed the bottles to the filling machines, and by employing the same method on the outgoing slat conveyor it is easy to guide the filled bottles in the right direction. The short length of gravity conveyor immediately carries the empty cases away from the man who has removed the empty bottles, and feeds them directly to the man requiring them for loading the filled bottles before placing the completed case in the refrigerator. The use of materials handling equipment in this instance undoubtedly saved considerable floor space, and it is easy to realize the amount of confusion that would exist, handling this quantity of milk by hand.

Plant executives have given scant attention to the use of common spiral chutes for lowering materials, as they consider them adaptable only to warehouses. These spiral chutes take up very little room, and are more efficient for lowering materials than the usual freight elevator. Figure 13 shows a closed center spiral chute, handling small cans of paint. This same chute can also handle a fairly large size box. In fact, it can handle a

(*Continued on page 49*)

It is not only the function of equipment to convey and elevate materials but it can also be used for lowering materials, and below is a special machine for lowering milk cans to trucks.







Even if the commodity to be handled is extremely fragile, breakage will be less when conveyors are used than when hand methods are employed.



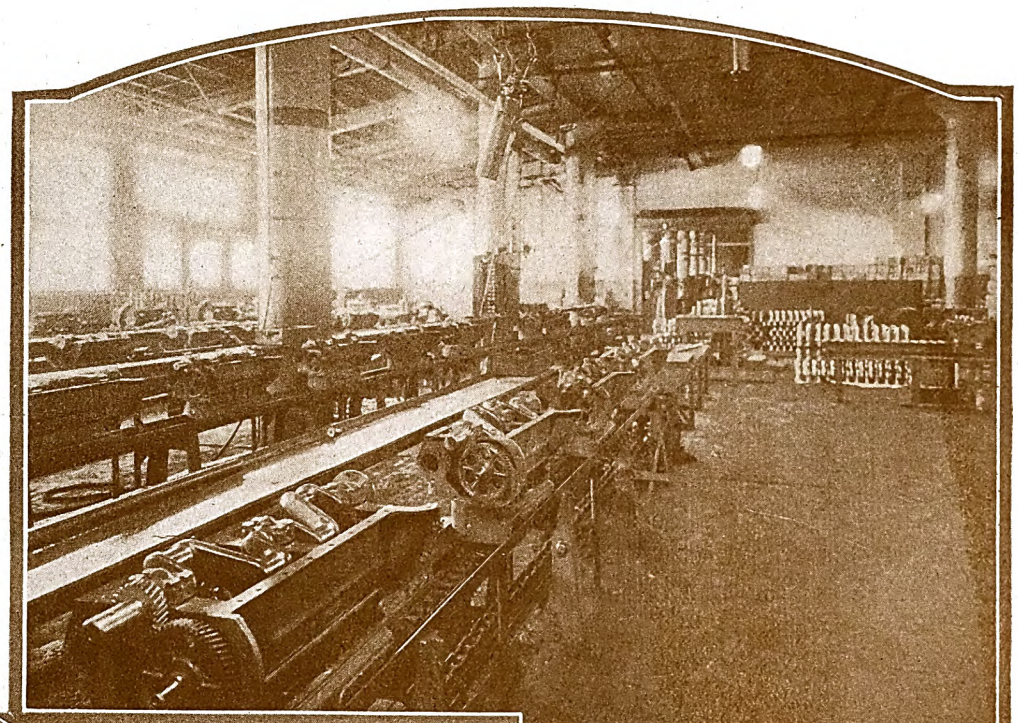
Installations do not necessarily have to be expensive. Simple equipment shown for loading trucks, saves enormous sums per year.

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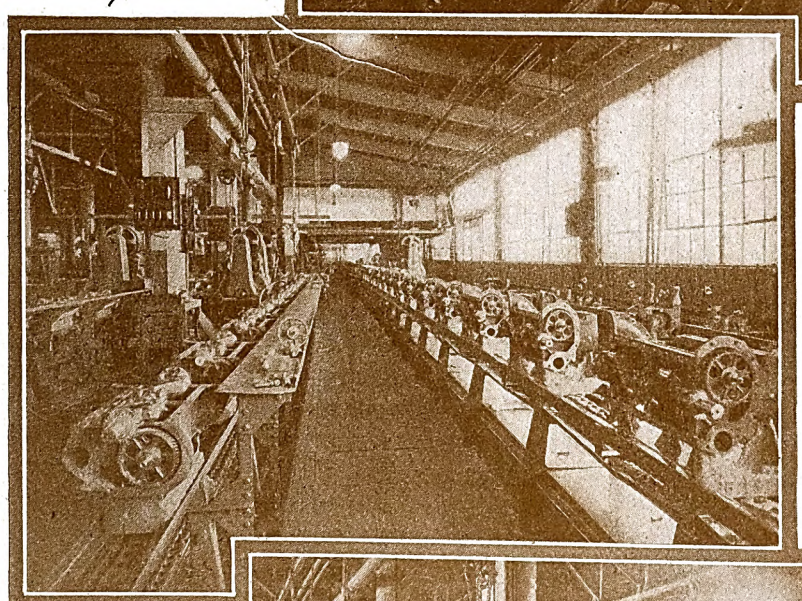
Assembling Fordson Tractors "On the Move"

More than Forty Tractors are Born Here Every Hour

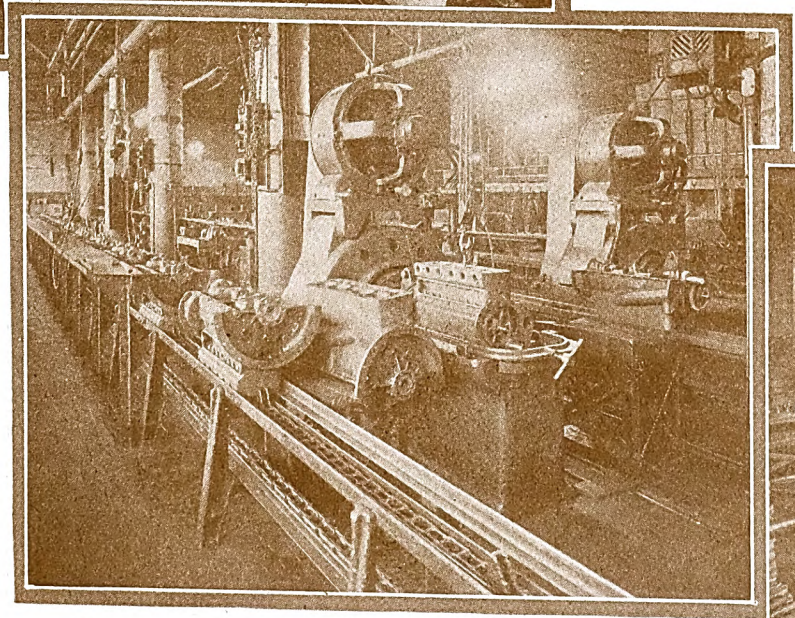
BY JOHN H. VAN DEVENTER



This is the beginning of the assembly of Fordson tractor motors. Note the chains for actuating the moving "lines."

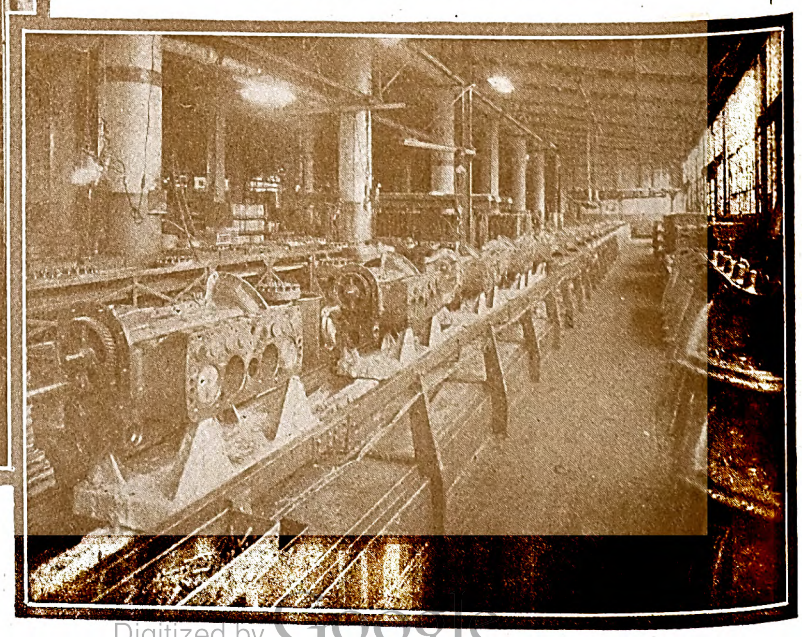


After the crank and camshaft assembly is completed, the motors are placed on the line at the right for further assembly.



Two of the burning-in machines where the crankshaft bearings are glazed to running finish.

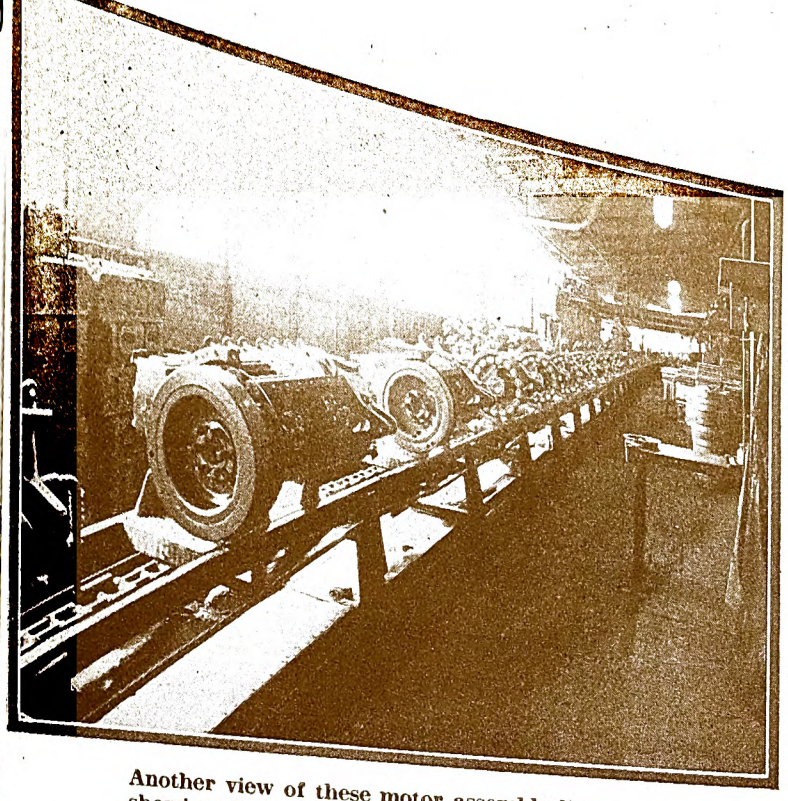
Below—Here the pistons, rods, tappets, springs, magnetos, etc., are added, the motors being completed at the end of this line.



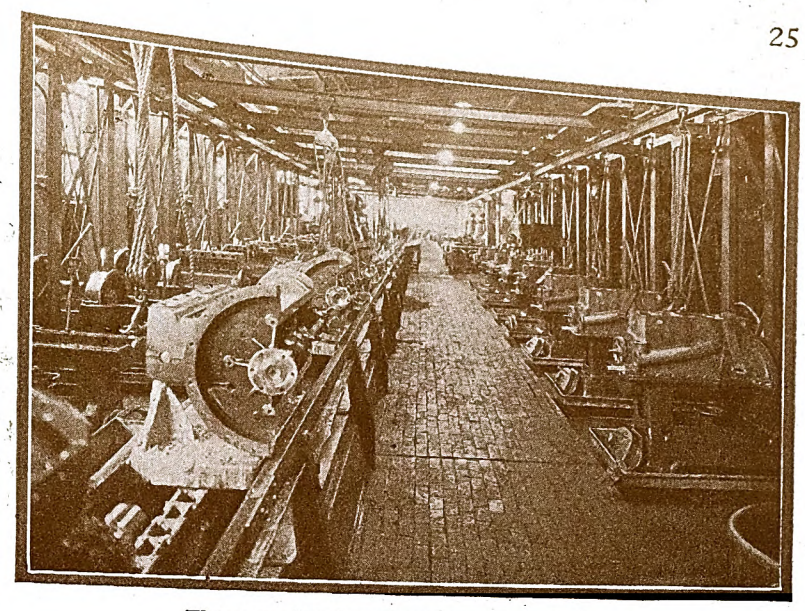
IT has been said that Henry Ford originated his moving assembly lines from an idea obtained by him after seeing the overhead carriers at work in the packing plants. For the meat-packing industry was the pioneer in adapting mechanical transportation in production, and particularly overhead trolley carriers to making the flow of work continuous throughout their plants. Whether this was the source of Ford's inspiration is perhaps immaterial, but it is interesting to reflect that the assembling of Ford cars and Fordson tractors on moving "lines" reminds one strongly of the process by which our pigs, sheep and cows are "disassembled" into lamb chops, pork chops and beef steaks. And while the one process consists in putting together and the other in taking apart, both of them through the systems of mechanical transportation employed, have been developed to remarkably high degrees of efficiency—from the production standpoint.

I have spoken in previous articles about the principles of "integrated manufacture" of which Ford's River Rouge

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Another view of these motor assembly lines showing the gradual completion of magneto and fly wheel assembly.

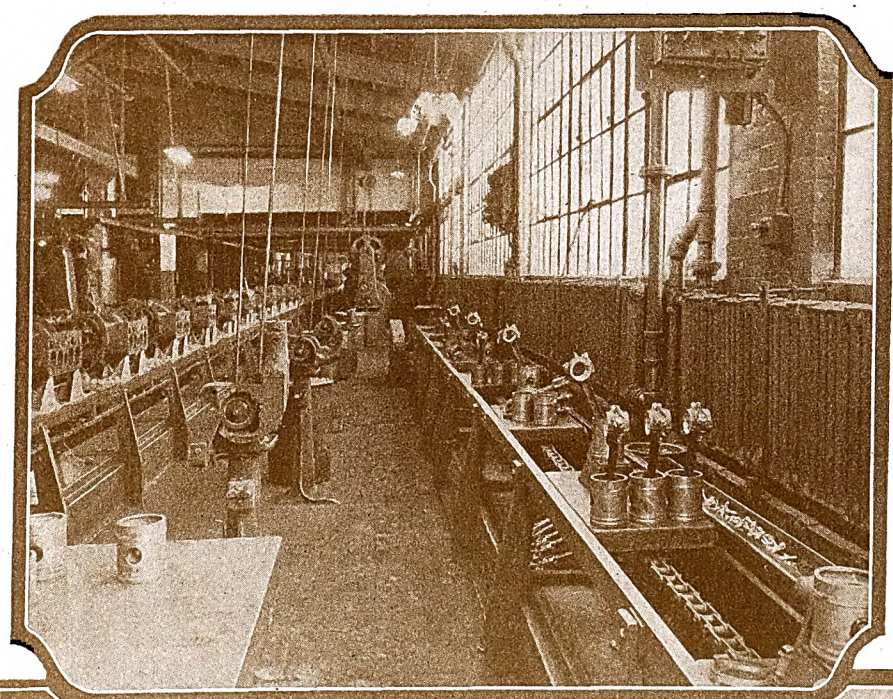


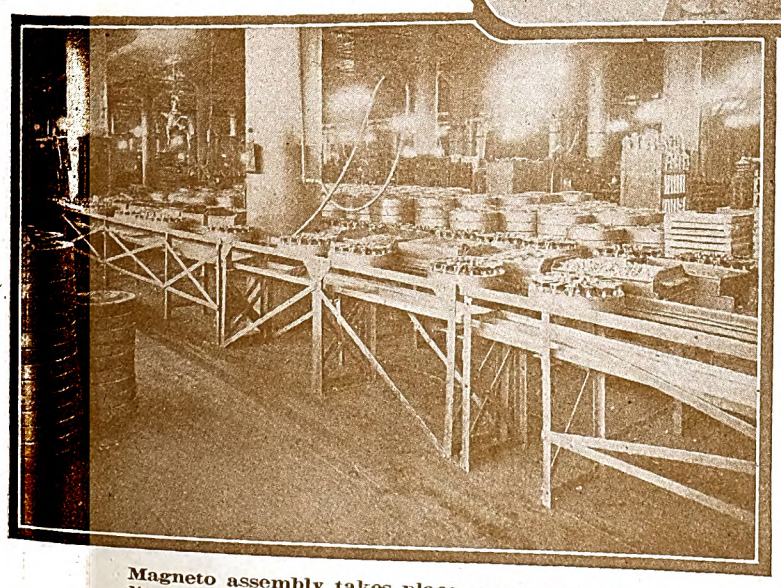
The completed motors are placed on the running-in machines at the right and driven at high speed to test the correctness of assembly.

plant is such a splendid example, and which is based upon arranging the work in continuous and regularly flowing streams which come together at the right place and time, and which finally result in a completed product delivered at a nearly constant rate. A system of this sort requires of course a huge output to begin with. It requires in addition, a huge outlay in materials, handling equipment, and possibly an even greater outlay for the brains to plan it. Once secured, however, it is a miracle worker with respect both to *production* and *cost,* because it eliminates not only "soldiering" but the even more prevalent time wastes which are incurred through workers not being supplied with the right materials at the correct time. And not only this, but a system of this sort reduces to a very minimum the amount of stock in process. At the River Rouge plant, where the integrated system is applied from the ore and coal piles clear through to the finished tractor, less than thirty days stock requirements are necessary to balance production schedules. Contrast this with the usual practice which involves tying up the interest of money invested in stock and materials for from ninety days to six months, and you will see what a tremendous saving is possible on such huge production quotas as are involved in the Ford industries.

At no other point in the manufacturing cycle can one visualize these savings as vividly as in assembly. It is here we have a spectacular demonstration of the rapid growth of a complicated machine starting with a few simple parts and ending with the familiar completed mechanism. It is an

Below is a minor assembly line also power driven on which piston rods and rings are fitted to the pistons.



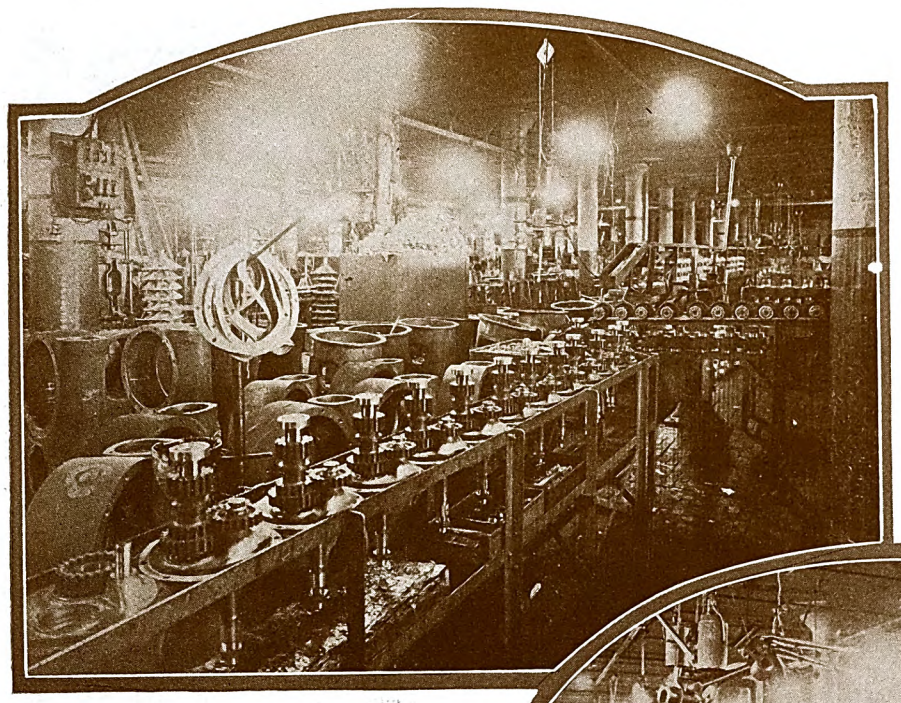


Magneto assembly takes place on a separate line running parallel to the motor assembly lines.

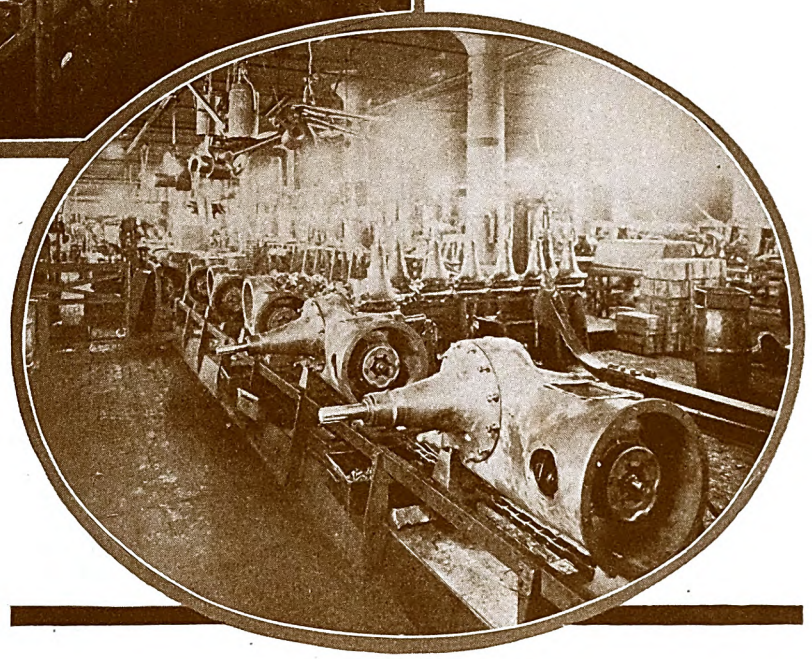


The completed motors are placed on this transverse conveyor line which carries them to the final assembly line. Meanwhile the front axles are attached.

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The progressive assembly of speed change gears for the transmission is shown in the picture to the left



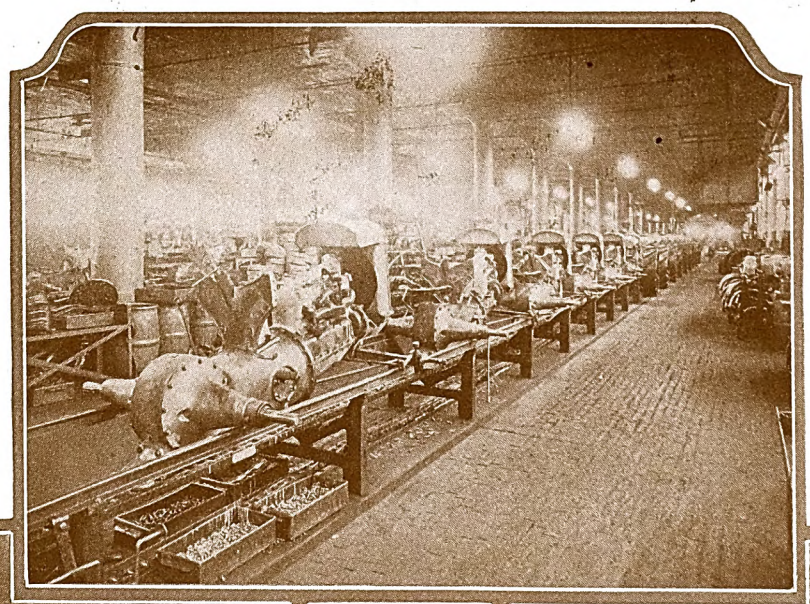
At the right are the transmission housings and rear axle assembly. Overhead may be seen special lifting devices for picking up the product.

object lesson in the power of mechanical coordination.

It takes an average of two hours and thirty-nine minutes for the complete assembling of a Fordson tractor from the time that the cylinder is placed upon the cylinder assembling line shown in our first picture to the time that the completed machine, fully painted and ready to run under its own power descends from the rails of the paint line shown in the last picture accompanying this article.

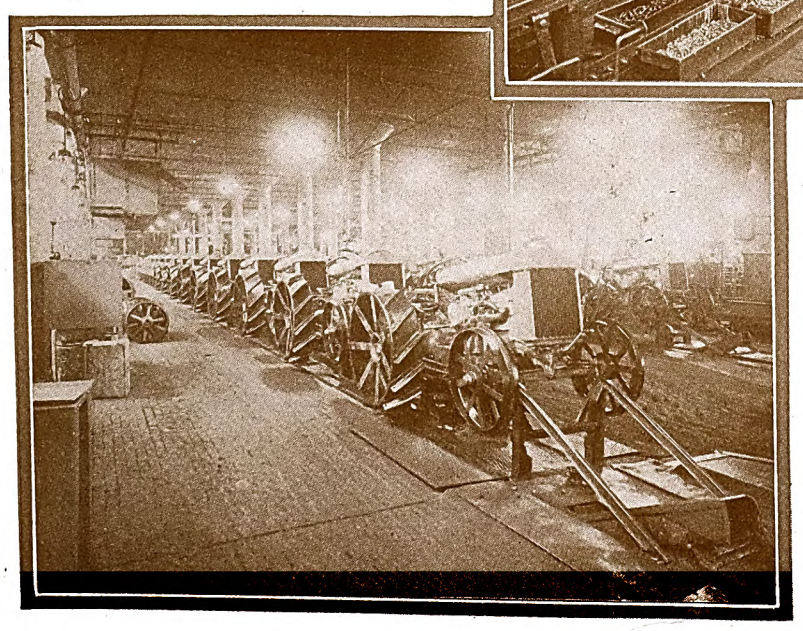
A number of parallel assembly lines extend North and South as shown in the first illustration. Here the motors are assembled and run in. Across the aisle and parallel to these lines are others on which the magnetos are assembled, the transmissions put together, and the rear axles and transmission housings completed. The direction of flow of these lines is from South to North. Here they meet a transverse line shown in the last picture on page 25, on which the front axles are attached to the completed motors. The final assembly lines run from North to South and start with the union of motor and transmission housing which gradually grows through the addition of radiator, fuel tank, steering gear, wheels, etc., into the recognizable finished product. The rates of movement of the various lines and the number of men working at them are adjusted in conformity with the demands

(*Continued on page 56*)

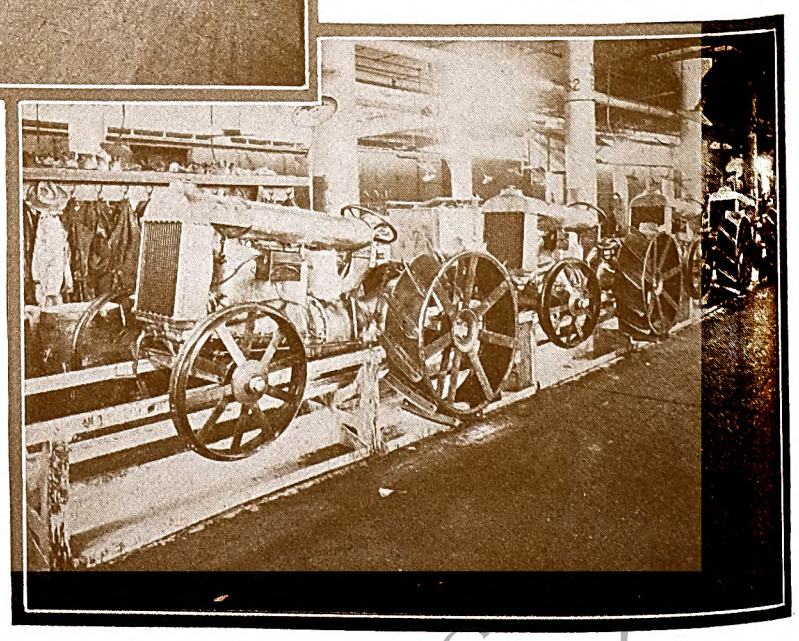


At the right is a view of the final assembly line. Here the first step is to connect the motors with the transmission frames shown above.

On this final assembly line the tractor grows step by step until in the foreground it is ready to come off and run under its own power.



This is a view of the paint line where the red and gray finish characteristic of the Fordson is given "on the move."



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(1) Before applying Skybryte and with no electric lights burning the light meter showed 7/10 ft. candle illumination.



(2) With three 100 Watt type "C" lamps and dirty glass meter registered 2½ ft. Candle illumination.

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(3) After cleaning with Skybryte all electric lights were turned off and light meter indicated 15 ft. candle illumination—an increase of 600 %

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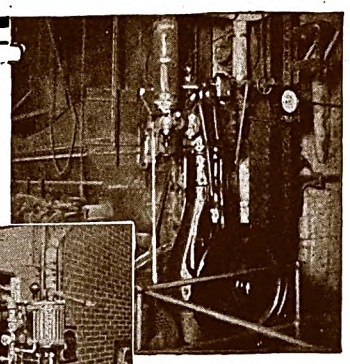
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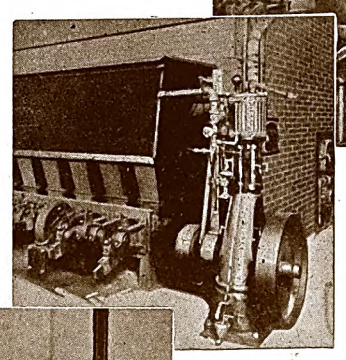
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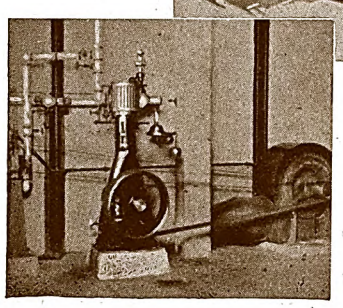
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The Why and How of Pre-Heating Fuel Oil

(*Continued from page 13*)

oil heater. In many cases it will be necessary to combine both these methods of heating.

While the natural characteristics of a fuel oil will govern the degree to which it should be pre-heated, to a great extent, yet the climatic conditions should always be taken into consideration. For example, a twelve degree Baumé gravity oil fired in the West Indies, where average atmospheric conditions might approximate 90 deg. F., would not require the same amount of steam for heating or as perfected a heating system as a similar oil fired in Northern Canada in the winter time, where the atmospheric temperature might continue at or below zero degrees for most of the time. Therefore, the problem of determining how and to what extent a fuel oil should be heated will in general be solved best by actual experiment and experience.

With the increasing necessity of resorting to the usage of heavier crude oils which may or may not have been topped of their lighter components, such as are obtained from the Mexican and Californian fields, the question of the potential danger involved in their heating is worthy of discussion. In order to reduce the viscosity of such fuel oils sufficiently it will in general be necessary to pre-heat them considerably above 200 deg. F. and, as has been already stated, oftentimes above their flash point. Due to the fact, however, that usually these grades of oil will have decidedly varying flash points, and since at best their content of lighter, highly volatile products will be relatively low, the amount of the oil tending to flash at temperatures in the neighborhood of 200 deg. F. will be comparatively slight. Since the flash will only be prevalent in proportion to the rate that these more volatile constituents are freed from the surface of the oil, and there will be little or no possibility of the entire volume of the oil flashing simultaneously, the hazzard will be practically negligible. Oftentimes such crude oils will flash at temperatures below 100 deg. F. when they are pumped from the wells. On weathering, however, in open storage tanks, or in the course of pumping and handling to tank cars or ships, the greater percentage of their more volatile hydrocarbon contents will vaporize and pass off into the air, either freely, or via vent pipes. As this occurs, it is evident that the tendency of the remaining oil to flash will decrease, and its flash point will be proportionally raised until it may be in the neighborhood of 150 to 175 deg. F. when the oil finally reaches the consumer.

There are a number of varying designs of fuel oil heaters on the market today, of more or less simplicity of construction according to the builders' ideas, etc. In effect, however, they all embody the same principle and strive toward the same end, *i. e.* to lead either live or exhaust steam around or through an arrangement of piping which is enclosed in a receiver or a similar pipe coil of greater diameter. The transmission of heat thus occurs by convection to, and conduction through the metal of the inner coil, either outward or inward, from the steam to the oil, the latter being heated accordingly. In general, fuel oil heaters can be grouped under the following classifications, although it can be appreciated that variations may be met with which at first sight might appear to fall in a class by themselves. The most prevalent types of fuel oil heaters are, therefore:

1. The Endless Coil.
2. The Double Pipe Coil.
3. The Film Type of Fuel Oil Heater
4. The Multi-pass Straight Tube Type.
5. The Return Tubular (straight) Pipe Coil.

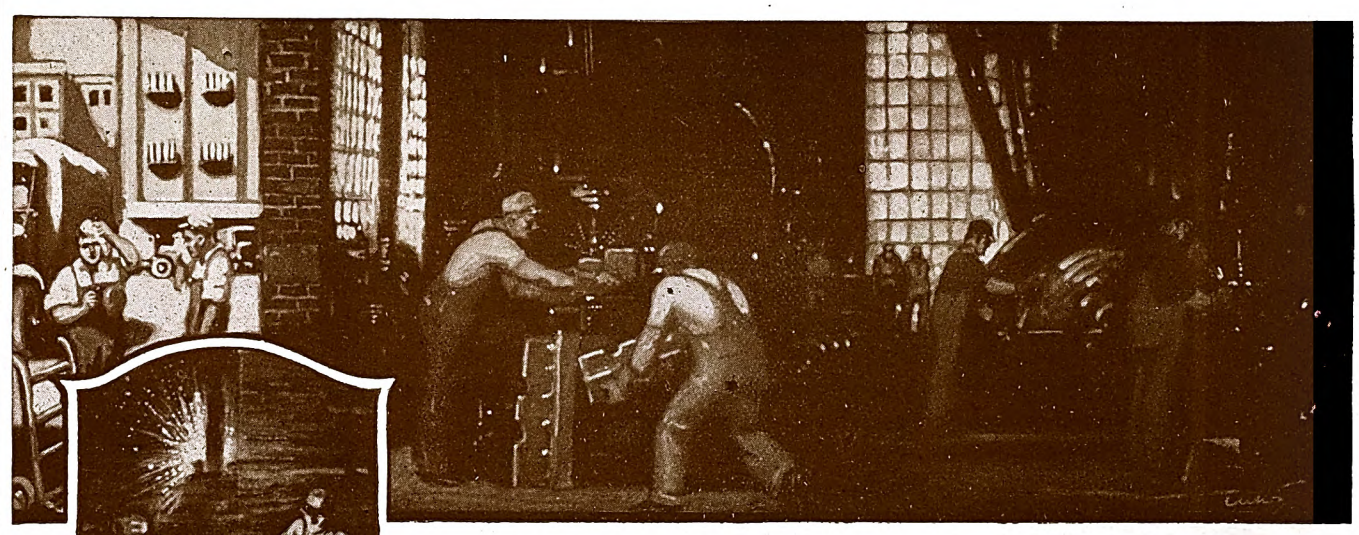
The Endless Coil.—This type of heater is usually composed of a cast iron receiver of varying size, containing one or more so-called endless coils of either copper, brass or iron tubing or pipe. For a high sulphur oil the iron coil is the more durable. Either live or exhaust steam as desired, con-

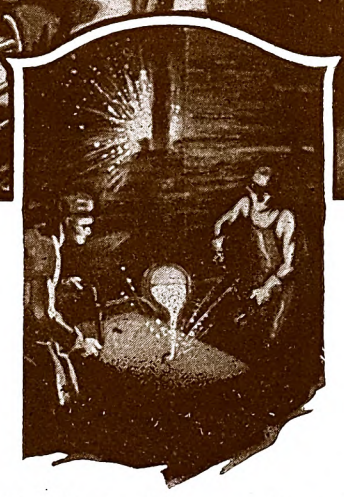
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trolled by a manifold, can be passed through this coil, the oil to be heated filling the body of the receiver and surrounding the coil or vice versa. The joints in such a heater are preferably best on the outside, and in one head only. Thus the removal of the coil or coils is facilitated for inspection, repair or cleaning. Such heaters are marketed in varying capacities, depending upon the number of coils to be installed. These coils are, however, generally of one standard size according to the make of heater. The rate of heat transfer in such a fuel oil heater is relatively high due to the large amount of heating surface which is exposed to the oil.

The Double Pipe Coil.—Perhaps the most practically effective type of oil heater within the reach of the smaller operator is the straight, double pipe coil, consisting usually of 2-inch (oil pipe) within 3-inch malleable iron (steam) pipe. In this heater practically perfect counter-flow of the mediums is obtained. All the joints are on the outside, and therefore cleaning and repair are materially facilitated. The end fittings are of the standard ammonia type. It is frequently customary in such an apparatus to install removable, spiral retarders within the oil pipe, it being the opinion that these tend to give the particles of oil uniform circulation and more intimate contact with the walls of the pipe, thereby effecting better heat transfer over the same heating surface than if the oil were simply pumped through straight pipe. In the erection of such a heater it is well to allow a slope of perhaps one-half an inch to the lowest pass in order to enable any condensed steam to flow out by gravity. This practice will insure against stagnation of water in the coils, and if the pipes are not sprung apart too far there will normally be no danger of leakage at the lowest return bend fitting. To determine the oil temperature at outlet the oil pipe should be drilled and tapped for a thermometer well or a special hot water thermometer, just beyond the outlet fitting. It is best practice to cover the 3-inch steam pipes of such a heater with a non-conducting covering to prevent loss of heat from the steam by radiation as much as possible. This heater can be built at a nominal expense in any fuel oil burning plant using standard pipe and ammonia fittings, and with average plant labor.

The Film Type of Fuel Oil Heater.—The principle of film heating has been adapted to a number of types of fuel oil heaters on the market, such as the multi-pass film heater, the corrugated film type, and others. In general such heaters are very efficient in their operation, and the rate of heat transfer is relatively high per unit of heating surface involved. The multi-pass film type of heater is built of close grained cast iron in the shell, being tested to sixty pounds working pressure. The heating element consists of steel tubes screwed into the cast iron head at one end, being free at the other for expansion and contraction. The oil tubes are tested to 150 pounds pressure. The velocity of the oil through these tubes is relatively high, the

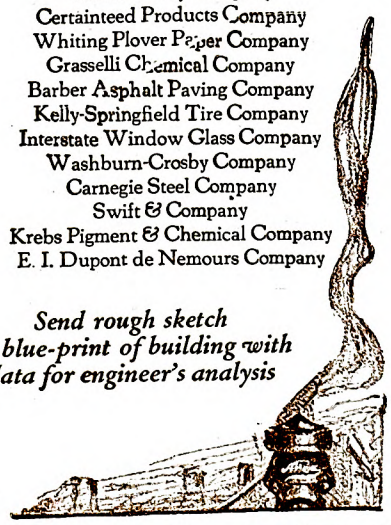




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oil passing from one section of the head to the other via a multi-pass construction as shown in Fig. 4 and by reason of the rate of heat transfer suitable heating of the oil at all times is assured. It can be noted that steam is in contact with the outside of the tubes, and short circuiting in the shell is impossible due to the installation of a steam baffle. As a result the steam sweeps the entire length of the heating surface with the maximum opportunity for giving up its heat. For this purpose either live or exhaust steam can be used, according to the degree of heat desired.

Another form of film type heater is shown in Fig. 5. In this device the oil follows a spiral path suitably controlled by baffles, around an inner shell contained in the main receiver. This heater is built of pressed steel and can be readily and rapidly cleaned as the Figures indicate. The feature of this heater is that there are no copper coils to be attacked by sulphur in the fue' oil. As well, the pressed steel construction affords maximum strength than in any other type. This with minimum weight. Steam enters the body of the heater as shown, being in contact with the inner surface of the heating shell.

The Multi-Pass Straight Tube Type.—The application of the multi-pass principle to the straight tube heater has brought about the development of another type of fuel oil heater that is considered to be among the foremost in regard to heat transfer and steam economy, and various claims are made concerning its efficiency. Essentially it may be regarded as embodying the same principle as the return tubular straight pipe coil, with the exception that it is possible to use smaller pipe or tubing for the coil, and the result that the rate of heat transfer will be much improved. In addition, according to the number of passes and tubes per pass, the medium within the tubes will be divided into a number of individual and parallel lots, instead of all passing in series through the same run of pipe as is true of the return tubular coil discussed hereafter.

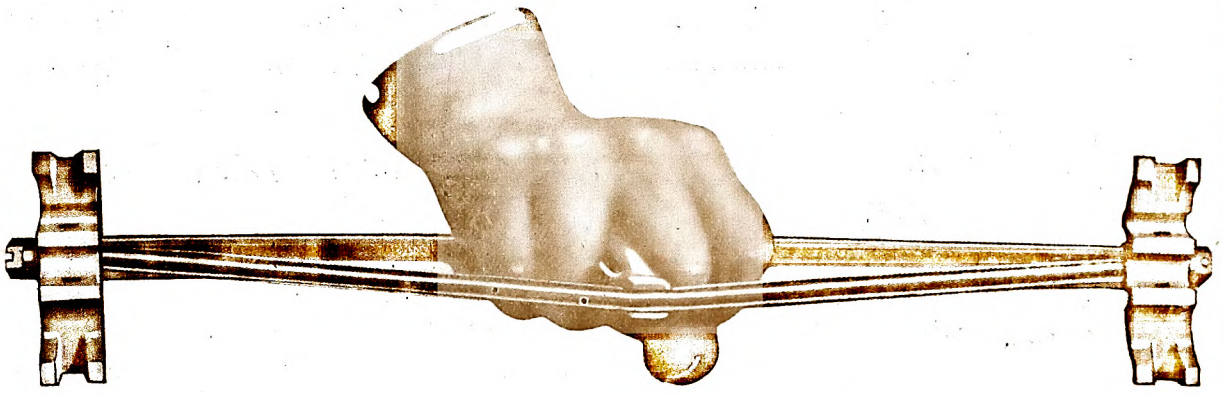
As usually designed such heaters are built with detachable heads which are cast with subdivisions to conform to the arrangement of the tubes. These latter may extend from end to end somewhat on the order of a condenser, or they may be built to return to the one tube sheet. The latter construction enables a heater of one head to be built, and it is more readily taken down for cleaning, inspection or repair. Up to six passes is the usual construction in heaters of this type, and it is customary to pump the oil through the tubes, the steam surrounding them and serving as the heating medium.

The Return Tubular Straight Pipe Coil.—For the engineer who must manufacture his own heating coil with nothing but standard pipe and fittings available, the most practical type of coil is the above as shown in the illustration herewith. The size of receiver, pipe and fittings will depend largely upon the fuel consumption of the plant, and the extent to which the oil is to be heated. For a smaller plant having in the neighborhood of

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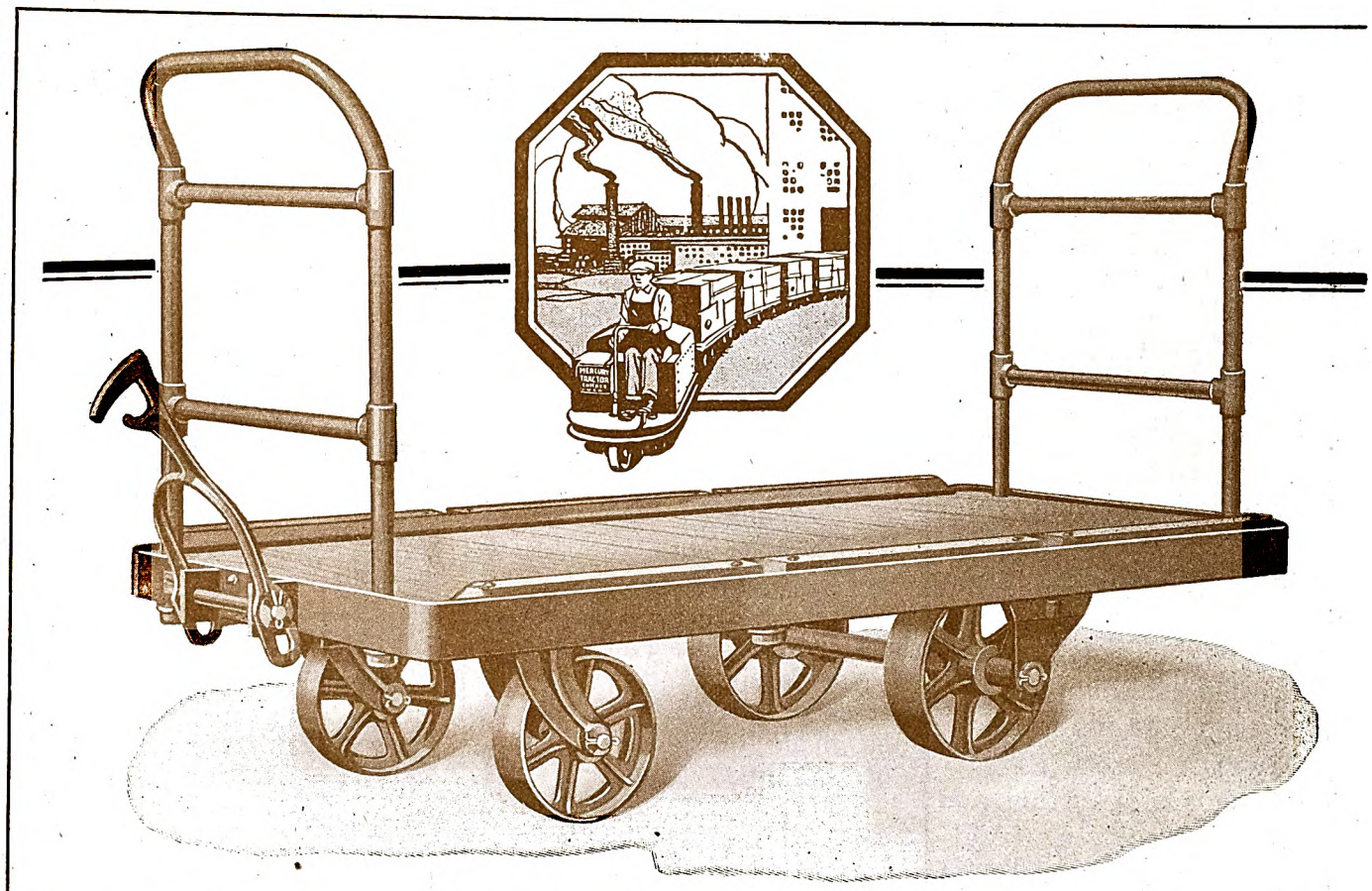
400 to 600 rated boiler horse power capacity, a heater composed of a receiver 18 inches in diameter by ten feet long, with four to six coils of standard one-inch pipe installed for steam heating has been found to raise an average fifteen gravity fuel oil from 90 degrees to 170 degrees (the firing temperature). This was obtained with a normal oil consumption of from one to two barrels per hour. It must be remembered, however, that the ultimate temperature will vary according to the velocity with which the oil is pumped through the heater, as well as the pressure of the steam, and the entering temperature of the oil. No definite data can, therefore, be safely quoted concerning the relative sizes of this type of heater for desired outlet temperatures of the oil.

The rate of heat transfer occurring in such a coil is relatively low as compared with the others discussed heretofore. It is, therefore, a more expensive apparatus to operate, from a steam and heat economy point of view, though its first cost will in all probability be well under that of the cheapest of the more intricate types shown herein. With second-hand material, and plant labor, such a heater can be constructed for about fifty dollars. The receiver should always be fitted with a thermometer and air vent at the top, and a drain for condensed steam on the under side, provided the heater is installed horizontally as is usually best practice.

In this type of heater there is a greater possibility of leakage occurring at the pipe joints fault can be prevented considerably by making up all such joints with a litharge-glycerine paste. To clean out tar residue, or other waste matter which may accumulate, a live steam connection can be made at the air vent fitting, and steam blown through to exit via the bottom drain. Inasmuch as both heads are best fitted as flange connected, either of these may be removed rapidly and easily for more through cleanout, or repair to the heating coil.

Heating Coils for Oil Storage Tanks.—Due to the fact that fuel oils will in general be so sluggish in the storage tanks as to render pumping a difficult matter at normal temperatures, means must be provided for heating such oils in the neighborhood of the suction pipe to a sufficient degree as will enable proper pumping to be carried out. Such heating is usually done by coils as illustrated. The purpose of such coils, whatever their construction, is primarily to heat the oil just enough to enable it to flow or be pumped from the storage tank to the main fuel oil heater. It is only rarely that an attempt is made to heat the oil sufficiently for atomization in the tank and do away with the main heater. Such practice is common where a light oil is used, and in warm climates, but for the average grade of fuel oil on the market today, and under normal climatic conditions, it is best to heat in the storage tank only enough for ready pumping of the oil, allowing the main heater to function as it is intended to.

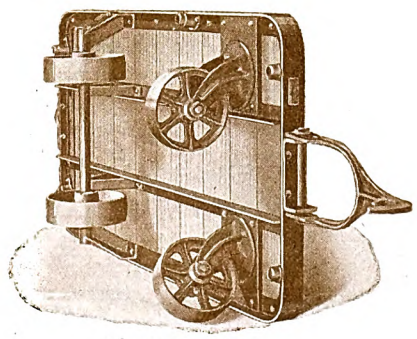
Heating coils for storage tanks are usually constructed as shown in the accompanying



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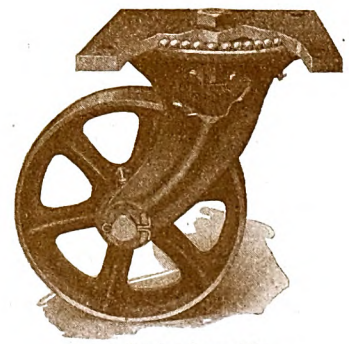
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A-310 Castor Assembly

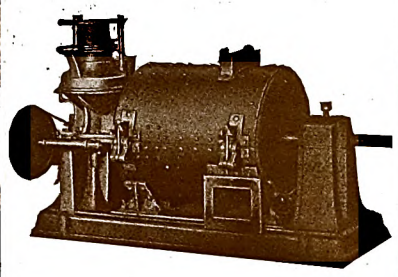
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illustrations. For the smaller capacity, horizontal tank a spiral coil surrounding the suction pipe has been found to give excellent results in heating the oil as it is drawn from the tank, and still avoiding waste of heat by heating the entire body of the oil in the tank. Exhaust steam, either from the oil pumps, the main exhaust line or the exhaust from the independent oil heater can be used in such a coil, and will be found to heat the oil sufficiently for pumping, whatever the weather conditions or the gravity of the oil. Except where a light oil is commonly used, or in very warm climates as has been stated above, such a method of heating should not be relied upon to heat the oil to a sufficient degree for atomization. With a circulating system the return oil, heated to firing temperature, should be led back to the storage tank via a vertical return pipe installed as close to the suction pipe as possible. Thereby heating of the suction will be increased and steam consumption for the coil decreased. Such a heater should be made of jointless, extra heavy pipe, tested to 250 pounds pressure. From six to eight square feet of heating surface will suffice, the over-all size of the coil being eight to twelve inches in diameter and about two feet high.

Another form of such a heating coil is shown in the illustration for a vertical cylindrical storage tank of larger capacity. The same type of coil is adaptable to a concrete tank. Such a heater should be located close to the bottom of the tank, set on an incline of supporting timbers. The slope should be about one inch per foot to insure proper drainage of condensed steam and to avoid stagnation in the coil and a decrease in heat transfer. For tankage averaging 25 feet in diameter, a 3-inch standard pipe coil will be ample to heat even the heaviest crude oil to a degree sufficient for proper pumping. All pipe joints in this coil should be made up with a litherage-glycerine compound to insure against leakage, and the inlet and outlet points at the tank shell should be connected by companion flanges fitting tightly with the same paste to prevent oil leakage.

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Stopping the Biggest Power Losses

(*Continued from page 16*)

He'll want to see them."

These are two plants, like which there are many others in the industrial field today. One is running hit-and-miss; the other has the benefit of intelligent supervision, based upon complete and continuous information on its efficiency of operation. The former is perhaps wasting 20 to 25 per cent. of the coal it burns, through lack of knowledge of the magnitude and location of its preventable losses. In the latter such losses are held to the minimum. When they occur, it is with the full foreknowledge of the management, who may judge it a matter of expediency to incur them, rather than undertake the measures of prevention immediately. Their presence is known and they will be wiped out as soon as possible.

The purpose of this article is not to go into detail of the losses common to boiler room practice and the methods of stopping them. That will be taken up at a later time. For the present we will be satisfied to point out what are the larger sources of loss in the boiler house, which react most readily to intelligent supervision and yield the biggest returns for the effort spent, where to locate them and to point out a few of the various types of instruments that are used for their detection.

The greatest source of loss in combustion efficiency in any boiler house is the gas that passes through the boiler tubes and carries large quantities of heat with it up the stack.

The amount of heat lost in this way depends upon the quantity of gases passing through the boiler setting and the temperature at which they leave the boiler.

It is essential, therefore, that the amount of gases must be no greater than is necessary for complete combustion, with the slight excess of air that is always necessary to attain that end. Any further excess of air does no useful work, absorbs heat from the hot burned gases, chills the furnace and the hot boiler surfaces.

Generally speaking, excess air comes from two sources, through burned-out spots in the fuel bed, and through cracks and leaks in the boiler setting. The best evidence of a fireman's worth is his ability to keep an evenly distributed fuel bed, covered with the proper thickness of coal. A bed that is too thin will let excess air pass through. Too thick a bed will result in a sluggish action, which is equally bad.

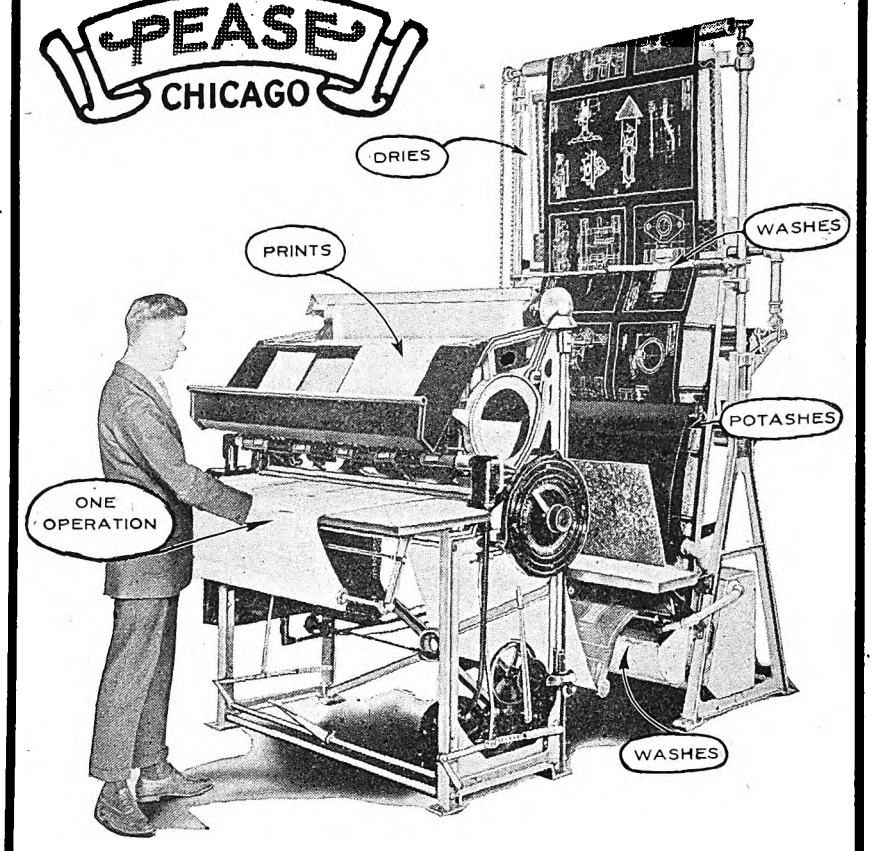
Cracks in the boiler setting are easily detected by inspection of the exterior brickwork. The air leak can be spotted by holding a lighted candle to the crack and watching the flame sucked into the opening by the current of air that is passing from the boiler room into the furnace. One of the best investments that can be made in the boiler house, from the standpoint of economy, is the coating of the boiler settings with a proper plastic cement "overcoat," making the setting air-tight.

Excess air cannot be seen, although its sources are quickly detected, once its presence is known. Reliable instruments are on the market, however, for detecting its presence and indicating the magnitude of the loss. CO_2 recorders they are called. They record the percentage of carbon dioxide in the flue gases leaving the boiler. The lower the percentage of C_2, the greater the excess air present.

The temperature of the gases leaving the boiler is also an important factor in the economical operation of the plant. This temperature must necessarily be greater than that of the water in the boiler, or no steam will be generated. There will, therefore, be a certain heat loss which cannot be prevented. Just how high this flue gas temperature must be, depends upon the design and type of boiler and the capacity developed by the boiler. Under heavy overloads the gases are being sucked through the boiler setting at relatively high velocities. The time of contact with the boiler surfaces is, therefore, relatively small. They cannot give up as much of their heat, as if they were passing through more leisurely. As a matter of course, therefore, we expect higher flue

(*Continued on page 35*)

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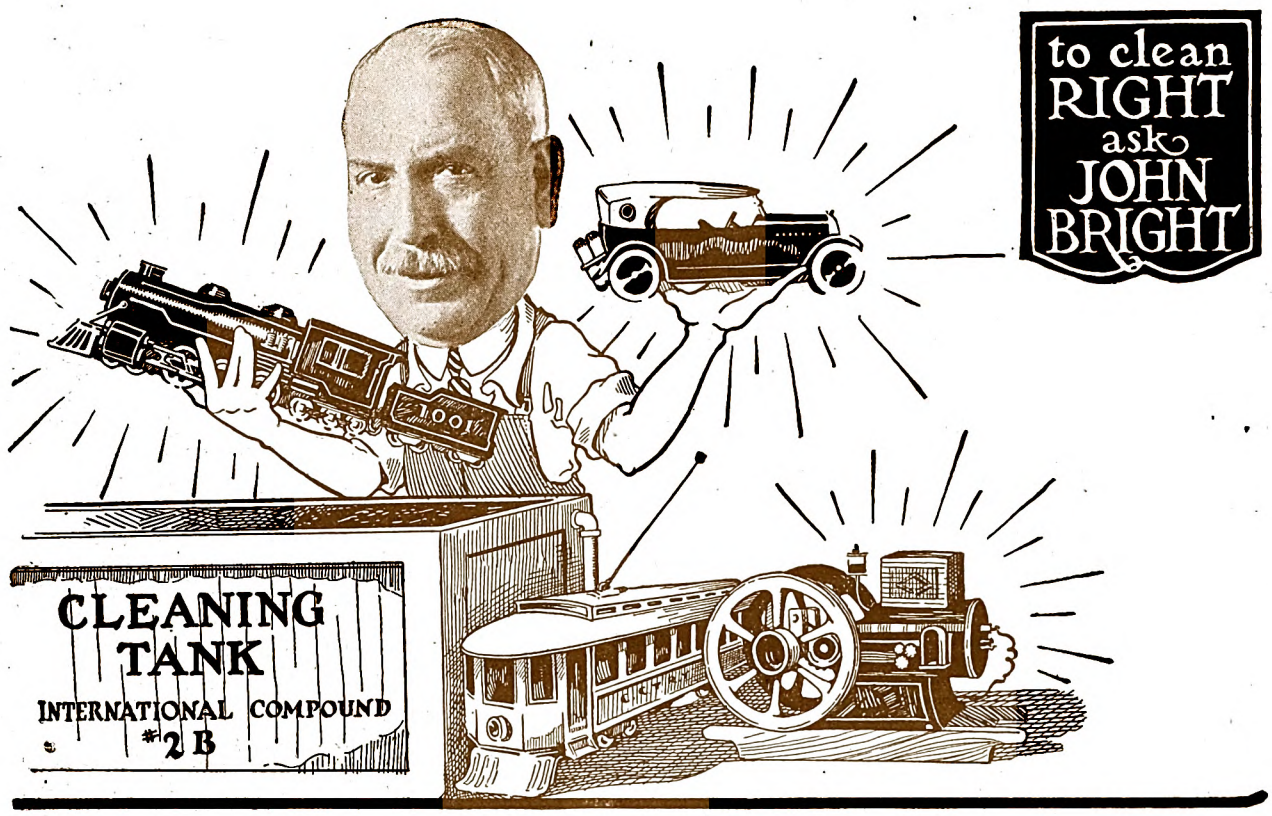
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(Continued from page 33)

gas temperatures when the boilers are forced than when they are normally operated. This we cannot prevent.

But the exit temperatures will also depend upon the cleanliness of the boiler surfaces, both inside and out. We have discussed interior boiler scale in a previous article. Boiler tubes also become coated with an exterior deposit of soot and slag formed by the chilling of the gases of combustion, when they strike the relatively cooler tube surfaces. It has been found that this action is reduced to a minimum when the boilers are set high above the grates, so that the gases are completely burned before they strike the metal of the boiler. In modern plants, the distance from the under side of the front header is usually not less than 10 feet.

When the boiler tubes become coated with a heat-insulating deposit of soot, the gases pass through without giving up their heat as readily and they leave the boiler at much higher temperatures. Such deposits must be secured from the heating surfaces at regular intervals, either with a hand steam lance, or, better, by means of steam-operated, permanently installed soot blowers.

There are many types of temperature measuring instruments for indicating and recording the temperatures of flue gas as it leaves the boiler setting. Each type has its advantages and gives positive information as to the condition within the boiler setting.

There is another common cause of high flue gas temperatures which we have not spoken of, namely, broken baffles. These baffles are usually of brick placed between the banks of tubes in such a way that the gases are deflected across the tube bank several times before they finally leave the boiler. Occasionally a brick will become cracked or loosened and falls out of its place, permitting the gases to shortcircuit through the setting without following their otherwise tortuous path. The result is that the gases are in contact with the boiler surfaces only a relatively short time and they leave the boiler at much higher temperatures.

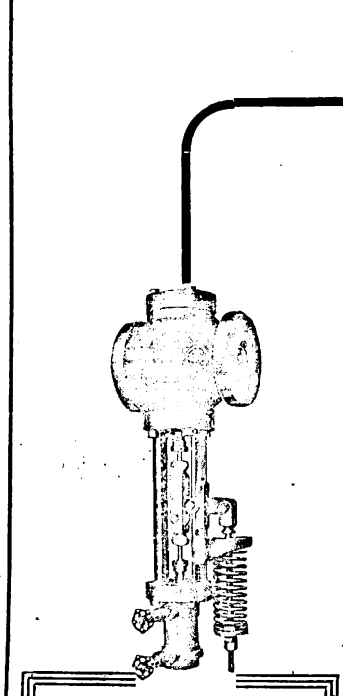
Suitable temperature indicating and recording instruments, therefore, indicate an excessive loss from these causes, which can be remedied at the proper time.

In actual operation, there is always a relation between flue gas temperature and percentage of CO_2 in the flue gases. When the CO_2 content is high, the chilling effect of excess air is a minimum (since the excess air itself is a minimum) and the flue gas temperature is correspondingly high. It is always economical, however, to increase the CO_2 (which means decrease the excess air), in spite of the fact that it results in a higher exit temperature of the gases.

Many engineers believe that the rate at which they can burn coal depends solely upon the air pressure through the fire bed. Such is not the case for, if so, a thick bed of ashes would burn as fast as a thick bed of coals, if we had the same draft conditions. The combusion rate of a fuel, therefore, depends also upon the

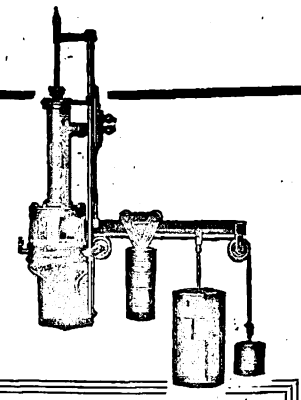
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MASON CONTROL



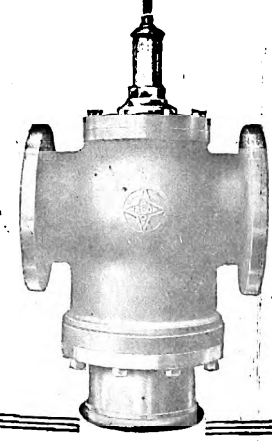
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Mason controlled plants mean less coal used per KW because of accurate and dependable pressure regulation on steam, air and water lines.

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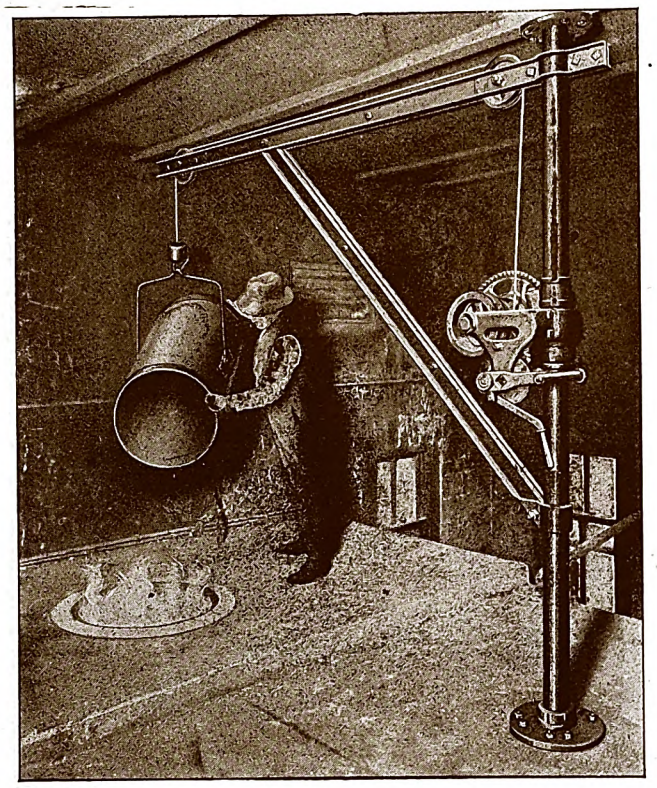
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Your own hoisting problem is probably quite different, but if you will tell us what it is, it is likely we can help you solve it so the loads (under 1000 lbs.) will be handled quickly, safely and economically.

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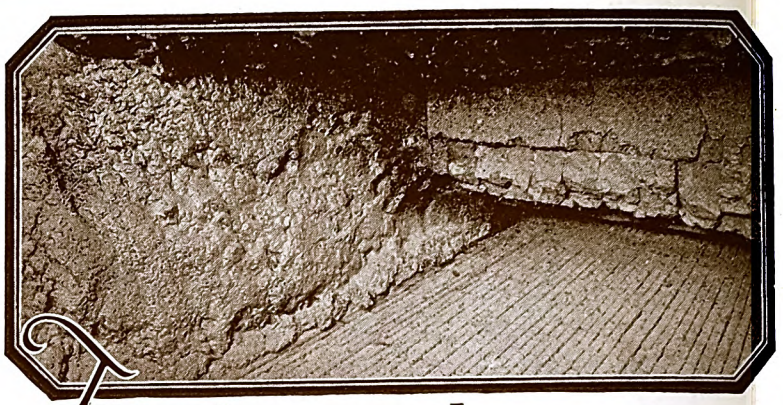
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Telescopic Hoist

with Automatic Gear Shifting Brake Device and Silencer

G&G



This furnace has not been relined in four years

AT the Otis Building, Chicago, there had been much trouble with fire brick linings. In the words of Charles Langs, the chief, "troubles and repair periods crowded on each other's heels so fast that we hardly knew whether we were keeping up steam on coal or brick."

Then four years ago, under four Edge Moor Boilers, they installed Plibrico.

These linings of jointless Plibrico have never been replaced. As Mr. Langs says "we have made practically no repairs and they promise a lot more of the same kind of service."

The reason for such long life? It's because in a Plibrico Lining there are no joints—the root of all furnace evils. Plibrico is a plastic lining that is applied with mallet and trowel. When baked, it forms a one-piece lining that is air tight, and gas tight, that resists temperatures to 3100 deg. F.

Ask for 50 page booklet. Plibrico is delivered only in steel containers of distinctive appearance as shown below. It is stocked in warehouses in 52 principal cities—see 'phone book.

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Demands Radiators so constructed that every square foot is prime heating surface.

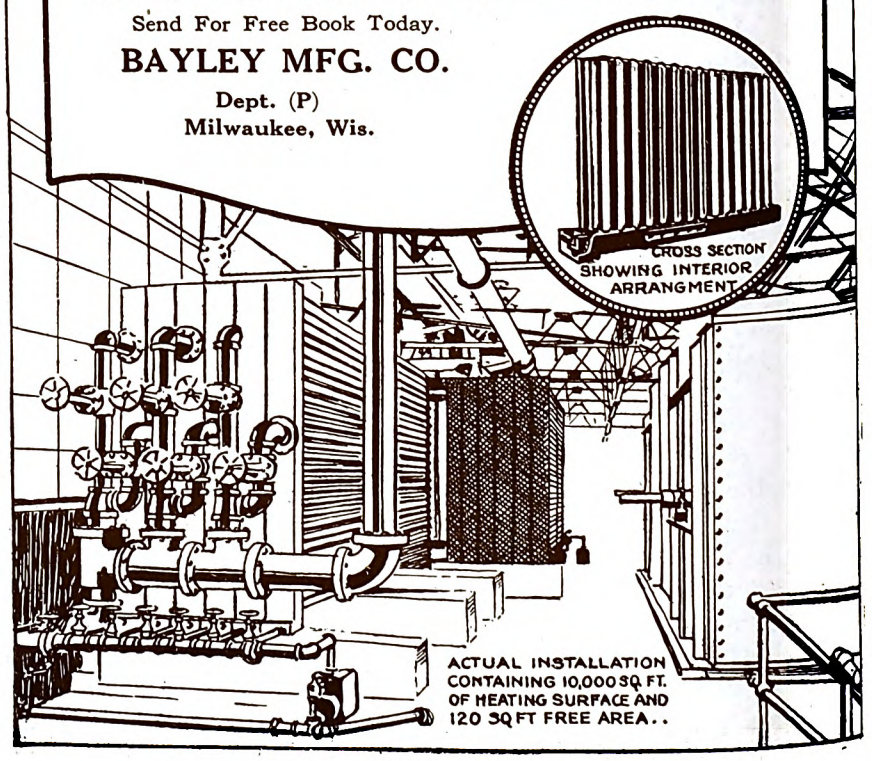
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are built on the "tube-Within-A-Tube" principle, every tube a complete radiator in itself, free from water hammer, return bends, elbows and nipples. Any tube can be removed without interfering with any other tube. Can be shipped K. D.

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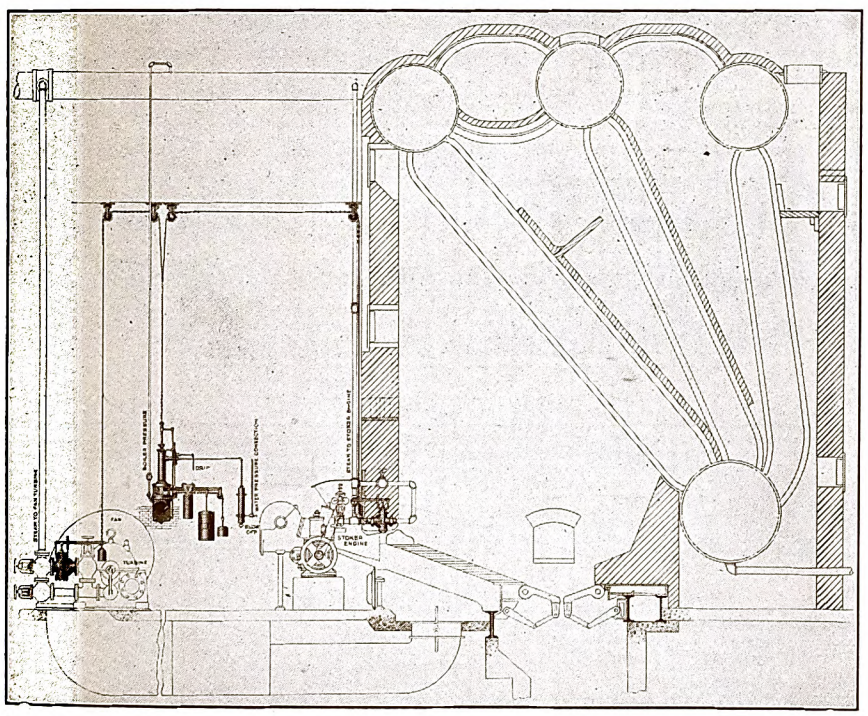
per cent. of CO_2 in the furnace gases, *i. e.,* upon the efficiency of combustion. By decreasing the excess air supplied, therefore, we can actually increase the capacity of the boiler. In some cases, in fact, the need for additional boiler capacity has been nullified by increasing the combustion efficiency of the entire plant.

Another source of loss in efficiency consists of the unburned coal that finds its way to the ash pile. The amount of this loss depends primarily upon the quality of the coal itself. It is easier to clean fires where a low-ash coal is being burned than where a high-ash coal is used. It is inevitable that some coal will find its way to the ashpit. When the loss is excessive, it may be due to lack of care in cleaning, undue haste in burning fires down before cleaning or to faulty, leaky and burned-out grates.

The necessity for knowing accurately the quality of coal delivered to the bunkers is apparent, since it is impossible to know if the ash loss is excessive or not without knowing what the coal itself is like. Furthermore, it is not sufficient to know how much heat you can get out of the coal, but also how much heat was in the coal in the first place, if worth while figures are to be obtained on the operation of the boiler house.

Obviously, in comparing economies and efficiencies from month to month the only fair basis is the ratio of the heat units input to the heat units output. This affords but another reason for knowing what kind of coal you are getting, as well as how much. Pounds of water evaporated for every pound of coal burned does not mean anything, since, obviously you may have a very good coal one month and a very poor grade the next.

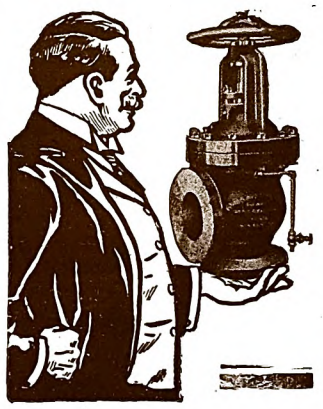
These statements should not be interpreted to mean that coal and water figures are not desirable or necessary. They are *both,* and suitable means should be provided for obtaining them. But they are only half the story.



In a subsequent article the subject of boiler room losses, records and economy will receive a more detailed treatment than has been possible in the limited space allotted to this article. At the present time it has been the writer's intention merely to describe the two major losses involved in combustion efficiency, their causes, how they were detected and stopped. It will be necessary to leave for the future the matter of analyzing all boiler room losses, keeping complete boiler room records and interpreting all the information gained with the view to increasing the economy of operation.

No Power Plant Manager Would Gamble With the Lives of His Boiler-room Men

Certainly Not—



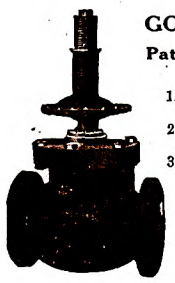
because if men are killed or maimed and the plant is wrecked it is then too late to think about good safety equipment—because if backflow of steam into a damaged boiler or a terrible pipe explosion took place, lives might be lost and a large capital investment wiped out—

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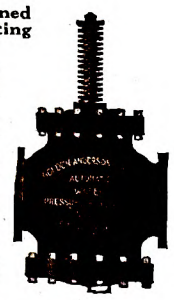
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8. Double Corliss Dash Pot that cushions in opening and closing.
9. Cannot pound, spin, stick or chatter.

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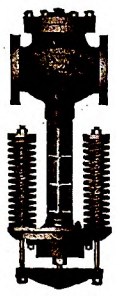
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6. Angle and globe pattern. Sizes 3 to 30 in.



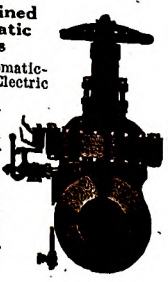
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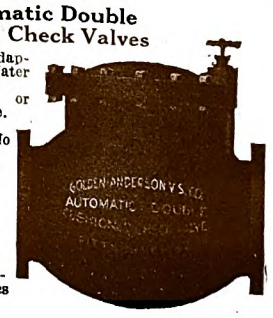


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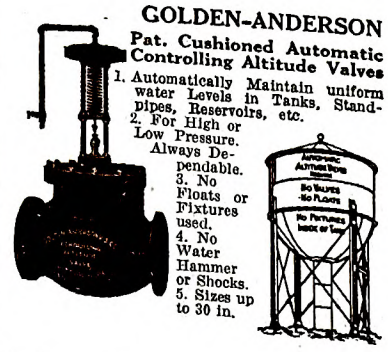
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1. Especially adapted for Water Service.
2. For High or Low pressure.
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Pat. Cushioned Automatic Controlling Altitude Valves

1. Automatically Maintain uniform water Levels in Tanks, Standpipes, Reservoirs, etc.
2. For High or Low Pressure. Always Dependable.
3. No Floats or Fixtures used.
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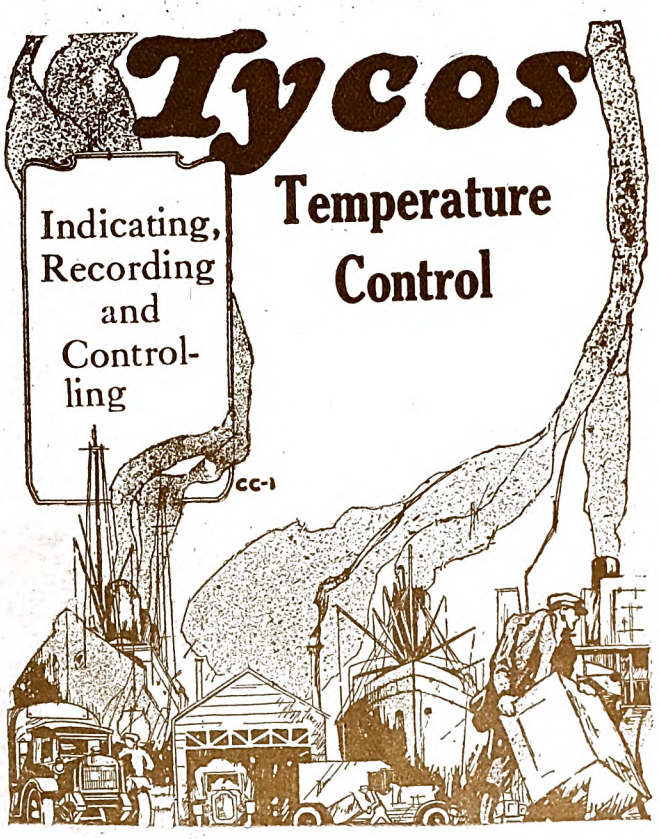
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Temperature Control

Indicating, Recording and Controlling



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I watch over the manufacturing processes of Industry. Whatever its needs I am ready. Twenty-four hours a day, seven days a week I indicate, regulate, and control temperatures.

In me is gathered the science of the centuries. I have taken the guess out of manufacturing, I have made manufacturing in vast quantities possible.

I am a money saver and a time saver. I am as accurate as a chronometer, as sturdy as a steel safe. Industry lives by heat. I regulate and control the life of industry.

I am *Tycos* Temperature Control—the Sixth Sense of Industry.

Tycos engineers have effected substantial economics for manufacturers in every line of industry by applying this *Tycos* "sixth sense."

Whatever your problem in the indicating, recording or controlling of heat, there is a *Tycos* Instrument to serve you.

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Taylor Instrument Companies

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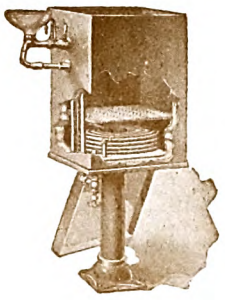


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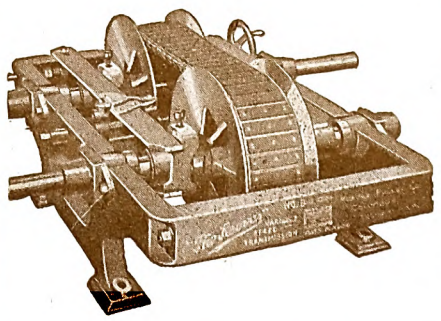
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"The Reeves" Transmission is installed between the source of power—motor, line shaft or engine, and the machine to be regulated.

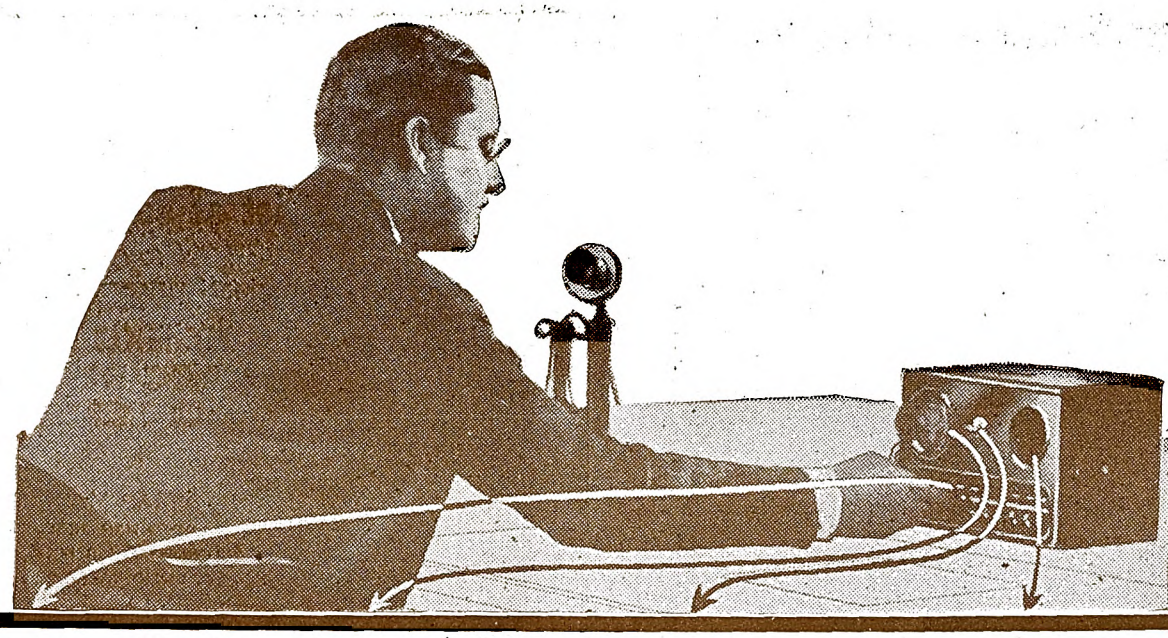
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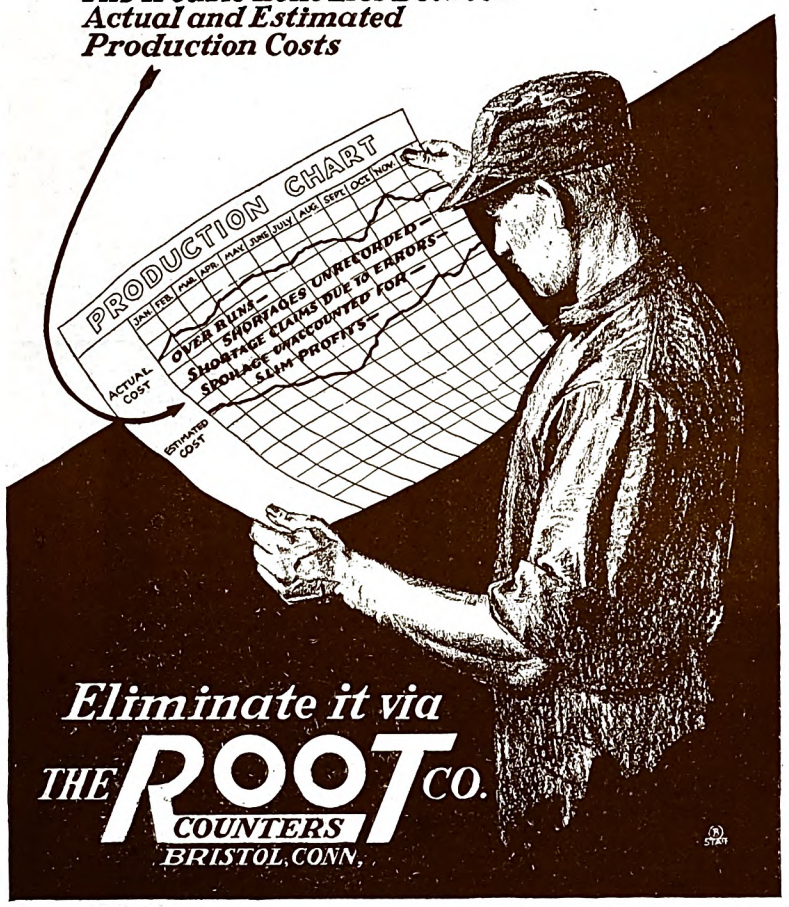
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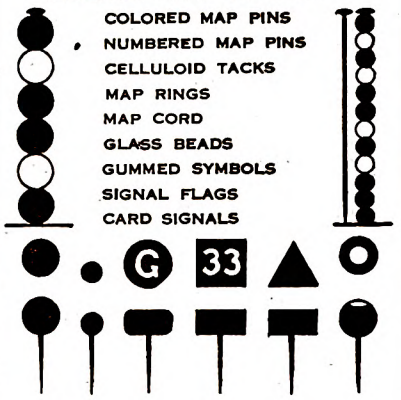
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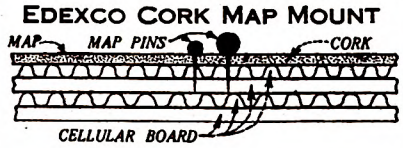
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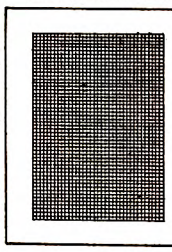
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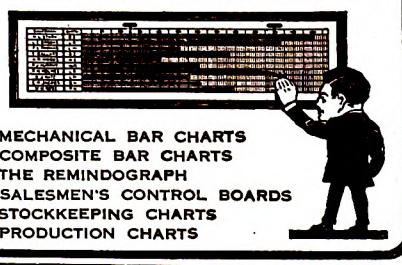
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Inspection in the Small Shop

By H. M. Brayton, M. E.

Research Engineer, Picatinny Arsenal

THE object of any kind of inspection should always be to insure a desired quality of product and uniformity. It depends a great deal, of course, on the product manufactured and the degree of perfection desired how much inspection is required. If the reputation of the company and its product depends entirely upon quality, the inspection must be very carefully done and no expense must be spared reasonably to insure the standard which has been set. On the other hand if the product is cheap and appeals to the public purely on that basis and the public does not expect high quality, then inspection can be made less. This point is one which only the individual manufacturer can determine.

It is probably true that the inspection in many plants is inadequate and not properly handled. In large plants where the product changes but little from year to year inspection becomes a mere matter of routine and gages can be made for every part. Cheap labor can be employed on the work and the cost is relatively low. In smaller plants, however, where the product or products vary, the problem is quite different and the manager or owner must decide in each case how much inspection he can afford to give the material made. He must think of this when he bids on the work and takes the contract. If the parts are those of a complicated mechanism he must make sure that each part has proper tolerences given on each dimension which are in accordance with good machine shop practice. If they are not, he should call it to the attention of the purchaser and if the latter still desires to have the close tolerences held, make the bid cover a possible excessive rejection on this part. It often happens that closer tolerences are specified on a drawing than are really needed and if the purchaser realizes it he will gladly change it to avoid extra cost.

Inspection in many small shops is handled directly by the foreman or assistant foreman. It may be taken care of by a so-called floor inspector. This latter individual is practically always responsible to the foreman. Therein lies an error in management. The same man, no matter who he is, should never have charge of inspecting the material which he has charge of making. The temptation to pass things slightly defective is too great. Every shop should have a chief inspector and as many men under him as are necessary to do the work properly and he should be responsible to the head of the firm or the manager. This is the only way in the majority of cases to obtain a good product.

Naturally foremen who have been brought up under the system of inspecting their own work do not like to have this function taken from them and sometimes they consider it a reflection on their integrity. It is, however, no reflection on the foreman to have the inspection handled by a separate department as there are few men in whom are combined the qualities of a good foreman and a good inspector. The points of view are quite different. One is trying to produce quantity and the other to insure quality. These are not always compatible.

Inspection in the small shop where only a few of each article are made is often a most difficult job. The quantity being made does not warrant the making of proper gages, and the inspector is forced to check the parts with the various measuring tools. Sometimes this is a difficult matter, though right, and calls for the use of a certain amount of mathematics especially trigonometry and geometry. This kind of work naturally calls for a high grade

(*Continued on page 43*)



"That grooveless oval crown saves us a lot of power"

TAKE any angle crown pulley and lay a belt on it. Note the absence of contact at the center of the pulley face where tension is greatest. Then try the same test on the Oneida. The belt hugs the oval crown providing contact all over the face. This permits loose belts—saves power—prolongs belt life.

Oneida pulleys are light—no superfluous pulley weight on lineshaft. They are strong enough for any service—easy to erect because of the split feature and grip the shaft securely.

On your next order for steel pulleys specify Oneida. Your local dealer can make immediate delivery.

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From Storage, the "Alemite" cylinders go through several machining operations and then are knurled.

Distance from last machining operation to knurling machine, 132 feet. *Time required to lift, haul and set loads with Stuebings,* 55 seconds.

Distance from knurling machine to washing and plating room, 165 feet. *Time required,* 70 seconds.

Distance from plating room to Stock Room, finished parts, 315 feet. *Time required,* 2½ minutes.

Distance from Stock Room to Final Assembly tables, 66 feet. *Time required,* 26 seconds.

Distance from Final Assembly to Shipping Room, 196 feet. *Time required,* 98 seconds.

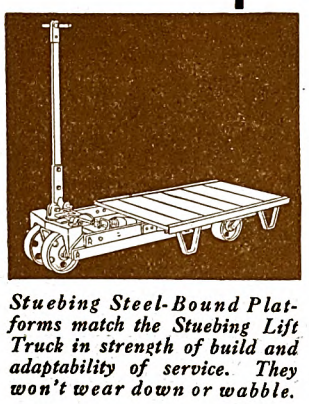
Stuebings cut interior hauling time until it can be figured in seconds

The Bassick Manufacturing Company of Chicago, manufacture "Alemite" Lubricating Systems—an assembly of comparatively small parts requiring many operations. The "progressive" method of manufacture is employed.

From storage shed to first operation, then to second, to third, and on through the various departments until the finished product is delivered to the shipping room, there's *not a lost motion or a wasted minute*, in the lifting and hauling of material with *Stuebing Lift Trucks*.

Trucking labor is cut to the minimum. One man does the work of five with ordinary trucks. All rehandlings are eliminated. Parts are taken from platforms, machined, and replaced on platforms. Loaded platforms are lifted, hauled varying distances, and conveniently set, with Stuebing Lift Trucks—*and the time required is measured in seconds!*

There is a uniform activity throughout the plant. The flow of materials is constant, even, *sure*. This is the method of material hauling you need in *your* plant. Write us today—a Stuebing representative will tell you about it.



Stuebing Steel-Bound Platforms match the Stuebing Lift Truck in strength of build and adaptability of service. They won't wear down or wabble.

The Stuebing Truck Company
Cincinnati, Ohio Montreal, Que.

StueBing
LIFT TRUCK SYSTEMS

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(Continued from page 41)

of inspector and the small manufacturer who desires to make sure that his product is right should not attempt to put a cheap man on such work. A good inspector who is on his job has a good moral effect on the workmen and foreman in the shop because they know they can not get a defective part by him. They will do their work better and for this reason alone, if for no other, it pays to put the proper man on such work.

When the part being made is one piece and expensive it is often well to have it checked by the inspector after each operation. In this way work is not wasted on a piece after it has been spoiled. The nature of the product and the amount of rejections will soon show the manufacturer how far he should carry this.

In addition to the regular inspection department, where all parts should go for acceptance after they are made, it is often well to have floor inspectors who may be under the foreman to occasionally check the work in the machines to see that the set-up has not changed. An automatic may start out at the beginning of the day doing perfect work and before noon be off just enough to spoil the work. It is true that the operator should check his own work at intervals but experience has shown that he can not be relied upon to do this. A floor inspector can catch such a condition and his presence will also act to keep the operator on his job. The floor inspector can also relieve the foreman in instructing the men how to do the work.

When drawings are issued to the shop a duplicate set should be issued to the inspection department. These drawings should be law to both the shop foreman and the chief inspector. The shop foreman should turn over to the inspector everything that is made but if he knows certain parts are defective and not according to drawing he should so tag them. The inspector's report will then show the total work produced and the amount accepted. The inspector in no case should be permitted to use his "judgment" in accepting material which is not strictly in accordance with the drawings. Inspectors are seldom capable of making such important decisions. They should reject anything and everything which is not right and the report of rejections and the causes given to the manager. The manager should then call a conference with representatives from all departments concerned, such as the engineering, cost, sales and manufacturing departments. This conference should thoroughly go over the matter of rejection and decide whether the defective parts are to be accepted. It may happen that the defects are trivial and will not affect the parts for the use intended. On the other hand the defect might seriously affect functioning or reflect discredit on the sales department who may have been making a point on quality. The manager should sit at the conferences if possible or at least review and approve of the board's recommendations. The data thus obtained will be of value to the sales department in making prices for the next order.

(Continued on page 45)



StueBing

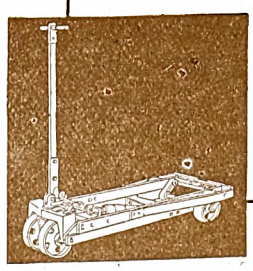
Adopts Timkens

The Stuebing Truck Company, makers of the famous Stuebing Lift Truck, now use Timken Tapered Roller Bearings.

Their Factory Manager, Mr. W. R. Stuebing, says, "We adopted Timken Tapered Roller Bearings only after a careful study of what we believe to be essential for heavy duty and long life. We found that the Timken Bearing not only showed easier operation and economy, but its cost of maintenance was extremely low."

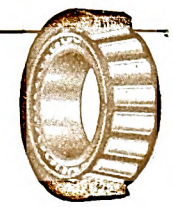
Timken Bearings mean better lift trucks—(1) because of the obvious labor saving effected by easy-rolling Timken-equipped trucks, which require lubrication only once or twice yearly; (2) because of the dual-duty ability of Timkens to carry not only radial loads, but also thrust and resultant loads; (3) because of the safety of perfectly-aligned Timken-equipped truck wheels; and (4) because when inevitable wear finally does occur, Timkens can be adjusted to function as when new.

The Timken Roller Bearing Co
CANTON, OHIO



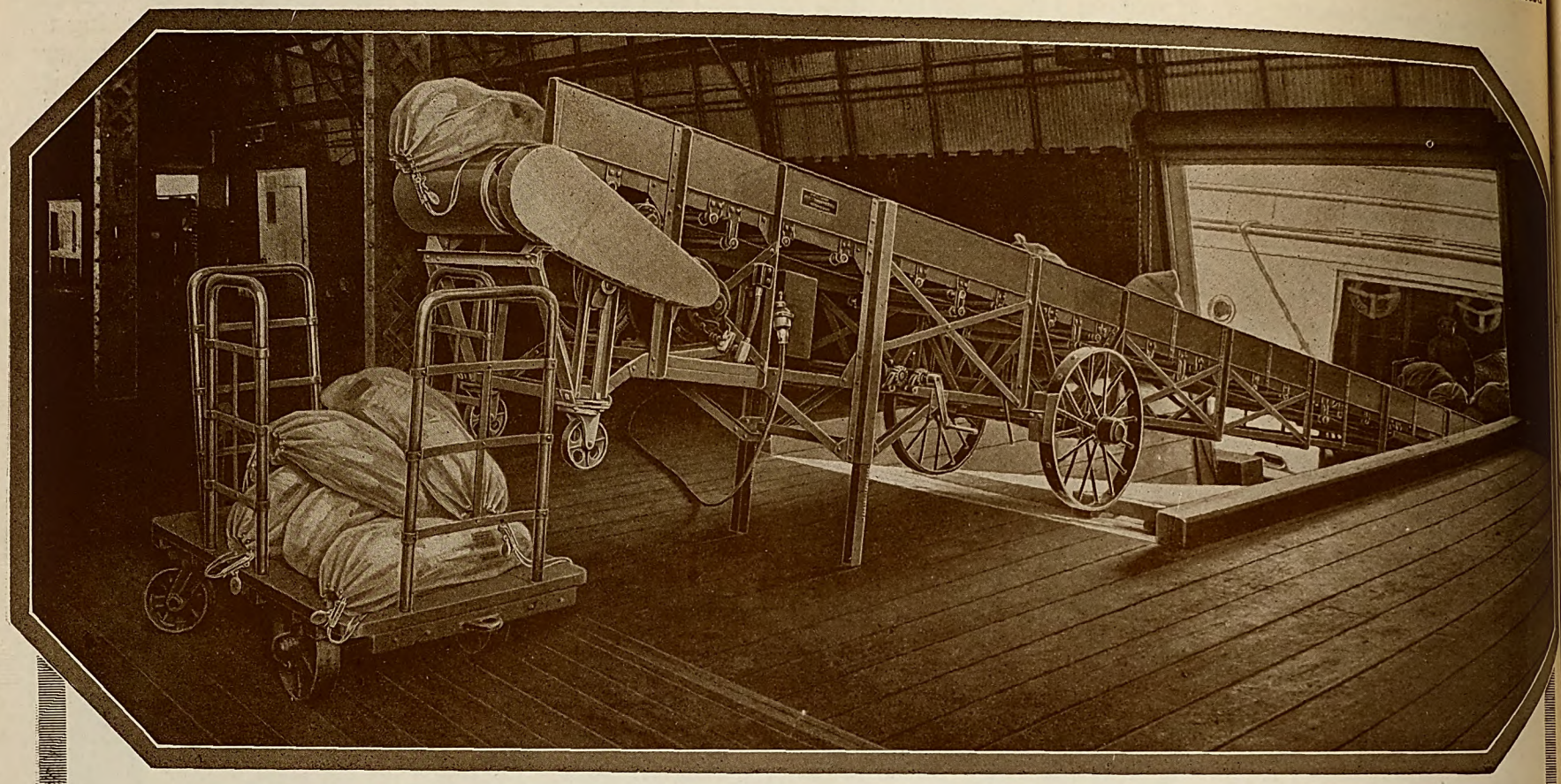
One man rolls a Stuebing Lift Truck under a loaded platform, lifts it with an easy pull on the steering lever, quickly moves it to any location, and safely lowers it to the floor.

TIMKEN
Tapered
ROLLER BEARINGS



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Have you given the question of Material Handling in your establishment the proper consideration?

It is a big problem worthy of your serious thought because so much depends upon how you handle materials. Take for instance the selling price of your product, if you are a manufacturer. Production without any question determines it. Conveying systems are the means of establishing and controlling production, inasmuch as they keep materials on the move continuously, so that all productive machines and assemblers produce to their utmost capacity.

The cost incident to the receiving and storing of raw materials as well as the shipping of finished product effects the selling price of your product. Rather than the slow moving elevators or trucks requiring attendants, materials can be elevated, distributed and lowered by automatic conveyor units with far greater rapidity at an insignificant cost.

Are you satisfied that your material is being handled properly? Are your operators and assemblers supplied with material? How much time is required to load cars or trucks? How long does it take to unload and distribute a car of raw material? If the remotest doubt exists in your mind allot a few hours to a survey of methods used.

We will gladly have one of our engineers make an analysis of your material handling problem and advise the type of Conveying System which will reduce your handling costs to a minimum.

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Loose, Bulk and Packed MATERIAL HANDLING SYSTEMS

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NEW YORK, N. Y.

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(*Continued from page 43*)

Interchangeability of parts is probably one of the greatest reasons for American success in manufacturing, now grown to such huge proportions. Without this standardization this great volume of business would not be possible in many lines. The day has come when the small shop has been compelled to fall in line or be forced under by the tide of larger competition. Often the small shop exists on orders received from large concerns which represent the overflow and save the large concern from having equipment to take care of the peaks of business. In such a case the small shop may work on parts which go with other parts to make up a complete machine. These parts must be made correctly and according to drawing or they are not wanted. A good inspection force is then a great asset to the manager. A reputation for accuracy is worth money to any firm but is especially valuable to the small shop.

Competing with the Cheapest Labor in the World

(*Continued from page 9*)

tance of 24 miles on one battery charge. Calculations were made by the municipal council of Shanghai and proved that this electric industrial truck could replace coolie labor at a very considerable saving. The calculations including interest, depreciation, driver's wages and cost of current show a cost of from 30 to 36 cents per cubic foot as compared with a cost of 90 cents for the much slower coolie-wheelbarrow method. Given the proper roadway conditions the showing would have been much better but as coolie and industrial truck operated over the same ground side by side the comparison is fair. The electric industrial truck won the competition with the cheapest labor in the world.

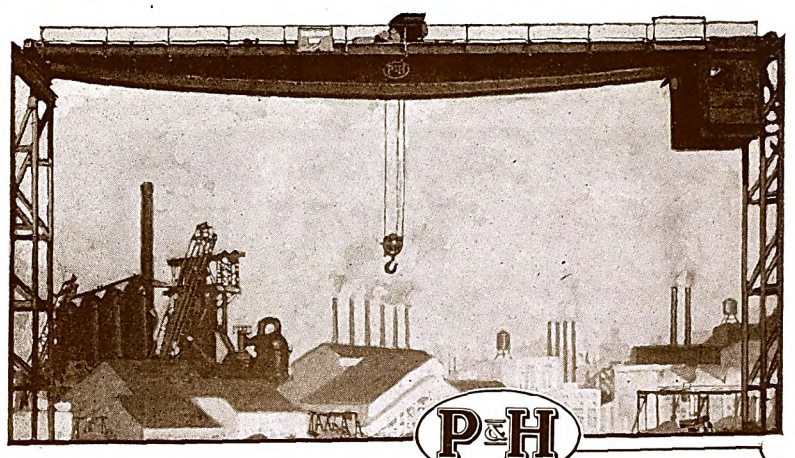
It has become an axiom with American engineers, and proved time and time again, that a good concrete road in connection with an industrial truck installation will pay for itself inside of a year. It is not unusual for such an installation to pay for itself within six months.

In China the industrial truck must meet competition from hand carts and the cheap coolie labor. The coolie can carry very heavy loads for considerable distances when it is put on his shoulder by a loading coolie, but give him a light load and he falls all over himself in handling it. Their inefficiency through loss of time taken to talk and argue among themselves is very great. Then, too, they must guard against the evil spirits who rupture them, and the hollering they raise to drive these evil spirits away together with their superstitions along other lines is not to be ignored.

In carrying loads with a bamboo pole and sling, the load is lifted only a few inches from the ground. This is the common method of carrying loads up to 800 pounds and only two men are required. Four men carry twice this load and their pay is only a few coppers a day. It is competition of this sort that the industrial truck has had to meet and it has shown that on short hauls, even though the loads be very heavy, coolie labor is the cheaper. However, on the longer hauls, as in the instance noted above as well as in and around warehouses and on the docks, industrial truck, tractor and trailers have proved their value.

In Japan and Manchuria, which is under Japanese control, will be found hundreds, yes, thousands of American-built chain blocks and electric hoists and some really good installations of American-made industrial trucks. With the importation and construction on the ground of heavy industrial machinery and much railroad equipment, it is not inconceivable that chain blocks and electric hoists should find a number of uses. In connection with the use of industrial trucks there is much missionary work to be done. The railroads, the government and a number of the larger industries are making a careful study of the uses and advan-

(*Continued on page 47*)



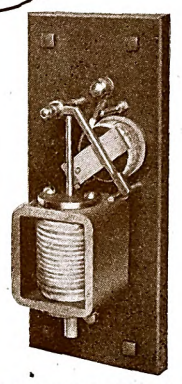
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As an outgrowth of years of P & H performance since 1884—complete confidence has been established.

P & H dependability has been demonstrated over this long period of time—dependability not only in long, unimpaired service of P & H products—but also in the P & H organization.

With the development in the art, the new features incorporated in P & H cranes have always been accepted with confidence by the industrial executive and engineer. One recent example of this development is the elimination of lost time due to slow lowering of light hook.



P & H QUICK-LOWERING RELAY

As auxiliaries to P & H Traveling Cranes and for buildings with low overhead—P & H Electric Hoists are extensively used for general material handling. The P & H Portable Crane on Corduroy Traction driven by gasoline or electric motor has also come into increasing usage about the industrial plant.

P & H Quick-Lowering Relays Eliminate Wasted Time

Apart from their inherent qualities, P & H Cranes have the distinctive quick lowering feature—the result of a patented Relay—which saves many hours per week, and gives the user crane service that is practically equivalent to a crane and a half for each crane.

P & H Cranes have been conceded leadership—the responsibility of which is thoroughly appreciated.

Bulletin mailed on request.

Crane and Hoist Division

PAWLING & HARNISCHFEGER CO.

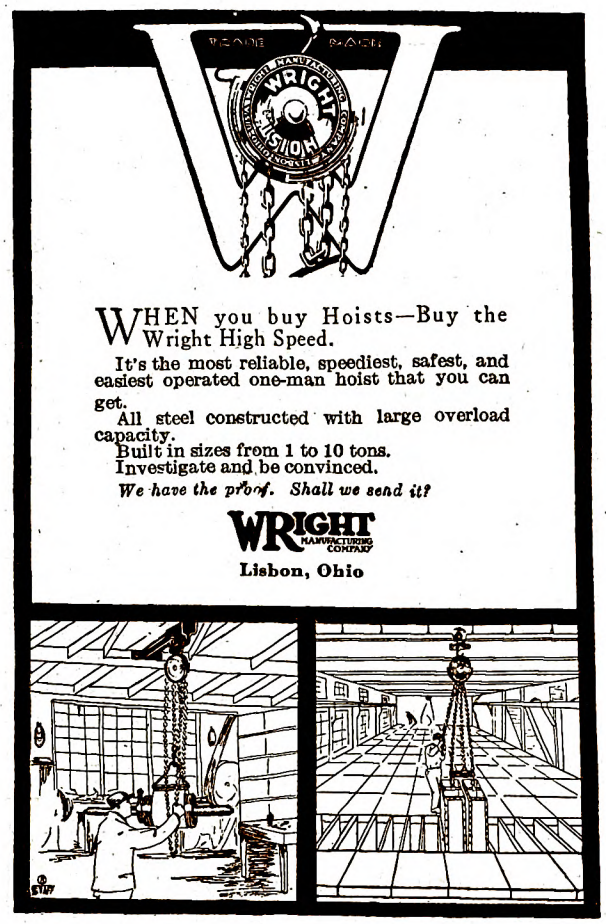
Established in 1884

3850 National Ave., Milwaukee, Wis.

New York, Pittsburgh, Phoenix, Seattle, Atlanta, Portland, Denver, St. Louis, Chicago, Philadelphia, Los Angeles, San Francisco, Birmingham, New Orleans

P&H CRANES and HOISTS

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WHEN you buy Hoists—Buy the Wright High Speed.

It's the most reliable, speediest, safest, and easiest operated one-man hoist that you can get.

All steel constructed with large overload capacity.

Built in sizes from 1 to 10 tons.

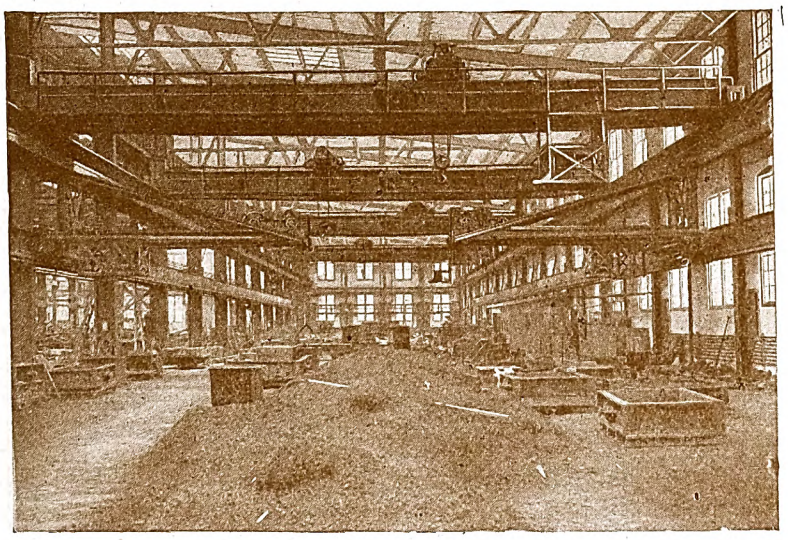
Investigate and be convinced.

We have the proof. Shall we send it?

WRIGHT MANUFACTURING COMPANY

Lisbon, Ohio

NILES CRANES



Save time—Save labor—Save space with modern crane equipment.

THE FOUNDRY is an example of a shop where several of the types of Niles Cranes can be combined to secure the utmost efficiency in the saving of labor and time.

The wall cranes shown take care of the various needs of the floor moulders in lifting and turning their flasks for them during molding operations. This leaves the overhead traveling crane free for the heavier and longer travel work of removing finished castings, bringing in molding materials, loading trucks or cars with castings and transporting molten metals during pouring operations.

The control of a crane that handles sizzling, white hot metal must be precise and absolute. One failure would be too many. This is one of the features upon which the reputation of Niles Cranes is built.

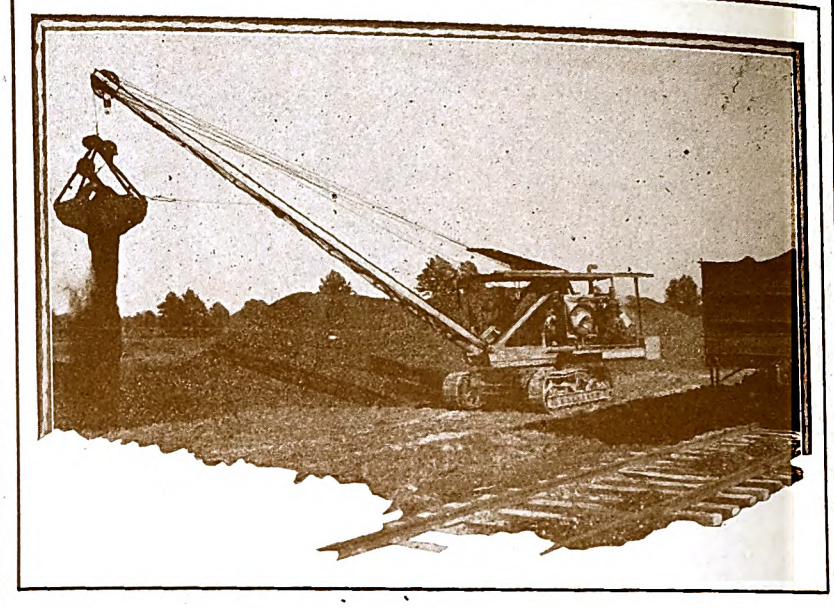
For the Steel Mill Rolling Mill, Foundry, Shipyard, Quarry, Mine Yard, Locomotive Shop, Forge Shop, Central Station and wherever heavy materials must be handled with speed, safety and economy.

NILES-BEMENT-POND CO.

111 BROADWAY — NEW YORK CITY

CRANE WORKS— PHILADELPHIA, PA.

No. 3 *of a series illustrating the many industries served by Niles Cranes.*



Gasoline Powered— Always Ready to Run.

High flexibility of power, simplification of mechanism and control make it a popular machine with every man that has used it—there are no fires to pull, no dials to watch—it is always ready to run and it always runs when the operator is ready.

Let us tell you what Northwests are doing now—and what they will do for you.

Write for the complete story

NORTHWEST ENGINEERING CO.

1231 Steger Bldg., Chicago

NORTHWEST CRANE DRAGLINE SHOVEL

GAS OR ELECTRIC

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(Continued from page 45)

tages of industrial trucks. The reports of foreign engineers who have travelled this country leave no room for speculation as to the time railroads, warehouses, ship companies and large industrial plants will be active industrial truck users. That time has arrived, but the Japanese will act slowly. The Japanese technical men have gone into this subject with considerable thoroughness. Fleets of American-built trucks, tractors and trailers are now being used by the Imperial Government Railroad and the South Manchurian Railroad, as well as by the larger steamship lines. The best installations are to be found in Osaka, Tokyo and Dairen. Platform trucks of the standard and drop platform types, tractors, trailers, crane trucks and elevating platform trucks make up these fleets. They are used at the water front on the docks, around the warehouses and in the railroad terminal yards, to do much the same work that they are put to here in the United States. The electric industrial truck has met the competition of coolie labor and hundreds of donkey carts. It has proved its value where the load was heavy, the haul long.

India, as might be expected, presents a none too fertile field for the introduction of materials handling equipment. But in the larger sea-port cities both chain blocks and electric hoists and even industrial trucks have found their way. The warehouses, railroads and larger industrials are practically the only users.

The work of the American and European engineers is one of continuous education in teaching these people the economy of materials handling equipment. But, the market is there in spite of the labor conditions which are the direct opposite to our own, and when these people are shown by actual demonstration the advantages and economies of the Occident's method of industrial transportation they are certain to recognize these advantages and adopt them.

THE United States Government sanctions working conditions that would not be tolerated by private employers, it is declared by the Federated American Engineering Societies, which appeal for a Federal safety program.

"The Government should, in its industrial plants, set an example to private employers, by providing for its own employees working conditions which are safe, hygienic and sanitary," says the statement issued by the engineering federation and prepared by Morton G. Lloyd, vice-president of the American Society of Safety Engineers, and member of the Board of Councillors of the Eyesight Conservation Council of America. Mr. Lloyd is chief of the Safety Section of the U. S. Bureau of Standards.

The engineers assert that these evils have been pointed out by Congressional Joint Commission on Reclassification of Salaries, but no remedy has been applied. Federal safety standards were drawn up during the war, it was said, but there is no officer with authority to enforce them.



How N. Y. Subway Could Pay the City $48,837

Great interest was manifested by the announcement that the City of New York would receive $48,837 as its December share of the net profits of the Interborough Rapid Transit Company—that a deficit of $194,000 in the last quarter of 1921 had been turned into a profit of $216,000 in the same period of 1922 in spite of an increase in the cost of coal of $669,000.

This is largely due to economies effected by the installation of various modern appliances—turnstiles, multiple-unit door control, etc.

The big lesson this saving teaches every executive is ECONOMIES CAN BE EFFECTED BY ADOPTING MODERN MACHINERY.

This is especially true in the handling materials—and Jeffrey Equipment has demonstrated it in hundreds of installments.

Jeffrey Material Handling Machinery includes a complete line of: Conveyors of various types; Chains; Bucket elevators; Portable Loaders and Unloaders; Portable Belt Conveyors; Coal and Ashes Handling Equipments; Industrial Locomotives; Crushers; Pulverizers, etc.

The Jeffrey Manufacturing Co.
946-99 North Fourth Street, Columbus, Ohio

New York.....2008 Hudson Terminal Bldg.
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Locations of Other Jeffrey Sales Representatives

Scranton, Pa....518 Union Nat'l Bank Bldg.
Cleveland, Ohio...828 Nat'l City Bank Bldg.
Denver, Colo.....1751 Wazee Street
St. Louis, Mo.....606 Pontiac Bldg.
Detroit, Mich.....455 Book Bldg.
Milwaukee, Wis.....M. & M. Bldg.
Boston, Mass.....141 Milk Street
Los Angeles, Cal.....H. W. Hellman Bldg.
Charleston, W. Va.....914 Kanawha Street

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HALLOWELL

STEEL LIFT TRUCK PLATFORMS



Save Renewals and Repairs on Lift Truck Platforms BY USING THE "HALLOWELL"

From time to time the all wooden construction must be repaired, and finally complete replacement is necessary, therefore, the initial investment is only a small part of the ultimate cost.

The robust design of the "Hallowell"—heavy steel angles and steel leg holders being securely joined by hydraulically driven rivets—renders it practically indestructible and, therefore, a very profitable investment.



Ends of runners are flared, as shown by above illustration, an exclusive "Hallowell" feature, which greatly simplifies entering the truck.

The value of this feature is soon realized by the workman after platform is put into service.

STANDARD PRESSED STEEL CO., JENKINTOWN, PA.

(The "Pioneer" Steel Hanger People)

INVESTIGATE

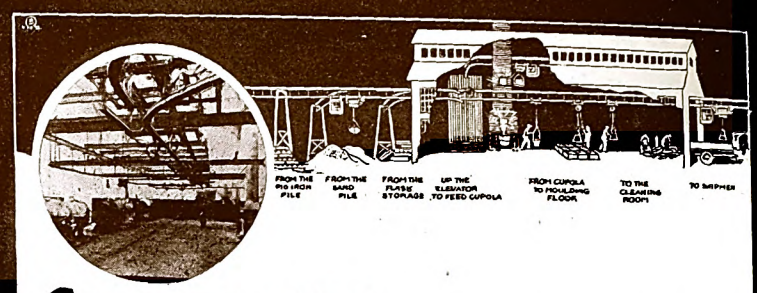
STANDARD PRESSED STEEL COMPANY, JENKINTOWN, PA.
Gentlemen: Kindly send me full details and prices of "Hallowell" Steel Reinforced Platforms.

Name.....

Company.....

Address.....

Truck used.....



CLEVELAND TRAMRAIL SYSTEM

HAND-OR-ELECTRIC

We are also Specialists in Appropriate Carrier and Grab Designing

• ***It Works "In" and "Between" Every Foundry Operation***

As *flexible* in its application and installation as a wheelbarrow yet never in the way.

Safer than any known method—quick and efficient.

Can be *installed quickly* and without any interference with your present methods of production.

Used in some of the largest as well as smallest foundries in the U. S.

It is the one system that will allow you to *cut down your costs.*

Our Engineers would be very happy to look over your plant and submit figures.

Shall we send them?

CLEVELAND ELECTRIC TRAMRAIL
THE CLEVELAND CRANE & ENGINEERING CO.
WICKLIFFE OHIO.

Which Installation Next?
Cleveland Tramrails are Lowering Production Costs in Every Conceivable Industry. Your Problem if not already Shown, will appear in these Inserts.
Watch Them

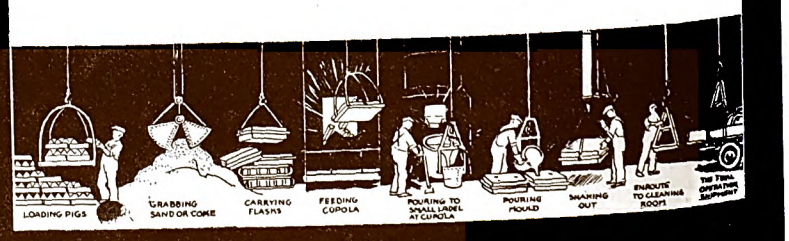
50 *Church St.*
New York City

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Chicago

500 *Arch St.*
Pittsburgh

2401 *Chestnut*
Philadelphia

149 *E. Larned St.*
Detroit



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Handling Parts and Packages

(*Continued from page 23*)

box as large as that shown in figure 8, which shows an open center type spiral chute.

The closed center type of chute occupies a minimum amount of floor space. The operation of this chute is simple, and effects enormous savings. A package descending such a chute will be forced against the guard rail, its speed being controlled by the friction on both the runway and the guard rail. The heavier the package, the faster it will tend to move. Consequently, the more firmly it will be pressed against the guard rail, and its speed will be reduced. These chutes can be loaded from any floor, and exits can be made from the chute to any floor.

Figure 8 illustrates the proper method of loading the spiral chute at intermediate floors, and shows how easily these chutes are fitted with fire doors at all floor openings. It will be noted that a freight elevator is located in the background of figure 8. The use of the spiral chute makes it possible to lower goods much more quickly than could be done with a freight elevator. Therefore, the elevator is used mainly for raising material between floors.

While figure 8 shows simple spiral chute construction, figures 11 and 12 show more complicated installations. That shown in figure 11 is the discharge end of a double blade spiral chute for handling mail sacks at the Post Office Terminal, Pittsburg, Pa. It is so constructed that two individual spiral chutes are carried on one center post, and through one floor opening. Where materials have to be segregated, this type of construction is cheaper in installation cost than two spiral chutes. A similar installation (figure 12) at the Union Terminal Post Office, Chicago, shows the method of feeding a multiple blade spiral chute from various overhead conveyors.

These illustrations show what it is possible to do, both in the feeding and unloading of spiral chutes. Frequently materials are too fragile or bulky to be handled in this type of chute, and in these instances it is recommended that gravity roller spiral chutes be installed. Figure 9 shows two spiral chutes for handling cases of bottles between floors, and illustrates the method of feeding these spiral shutes, so as to eliminate the large circular opening which would be required if the chute passed through the floor.

The full circular opening is required in the case of gravity roller spiral chutes, because of the low grade of the conveyor run; such a circular opening is shown in figure 10. Where the full circular opening in the floor is used, it is generally difficult to provide the proper fire protection, and in some states it is necessary to house the entire chute in a special fire proof well.

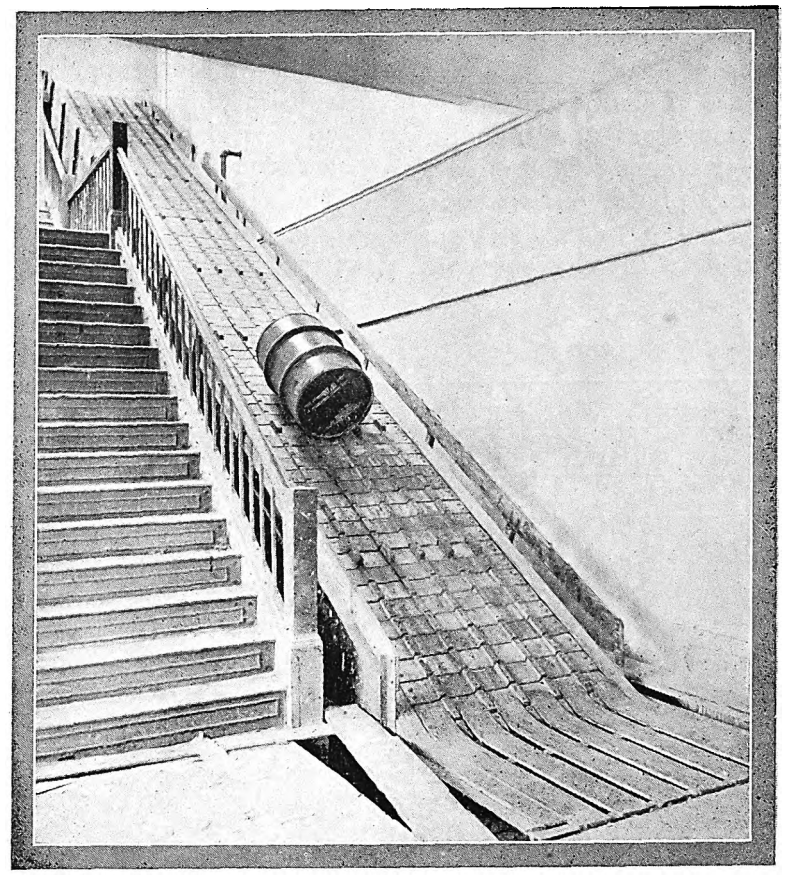
Thus we see that materials handling equipment can be used for lowering of materials between floors, whether such material is heavy, light, bulky small, non-breakable or fragile, and the same is true in the elevating of materials between floors.

Platform freight elevators are intermittent in service, as they have to be loaded, elevated or lowered, and then unloaded. For this reason, push bar elevators, arm and suspended tray elevators are installed, so that a continuous stream of material can be handled. In addition, practically all types of conveyors have been fitted with attachments to serve as elevators, as shown in figures 20, 29 and 31, and frequently such an application and installation is justified.

A typical push bar elevator installation is shown in figure 22, for handling push trucks in a textile plant. A very good combination of slat conveyor and push bar elevator is shown in figure 9, and is recommended where the load is to be carried, instead of slid up the incline.

On the elevating operations, arm elevators, suspended tray or finger elevators are more highly recommended than the use of some type of conveyor, fitted with attachments. With this class of equipment, the load is carried, and vertical lifts can be obtained.

A typical installation, showing a suspended tray elevator handling boxes is shown in



Replacing a gang of laborers at lower cost

UNSKILLED labor is scarce—why not put your truckers on more productive work? An A-F Conveyor system will replace a gang of truckers in your plant. It will do their work faster, better and at lower cost. These conveyors handle material of all descriptions, and operate where truckers cannot work. Gravity furnishes power for all downward movements—requiring little attention and asking no wage. Where a lift is necessary, power conveyors carry the material with maximum speed and minimum cost.

A-F Conveyors

Your work may be out of the ordinary, but there is an A-F system to handle it at a great saving in labor and expense. A-F conveyors are designed and built to meet individual requirements. Where standard machines are not practical, our Engineering Department will design a special conveying system to meet your needs. Why not find out how A-F conveyors can help you meet the growing labor shortage, at a saving of both time and expense: The benefit of our years of experience is yours for the asking. Write us today.

Alvey Ferguson Company, Inc.
Cincinnati **Ohio**

CONVEYING A-F MACHINERY

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figure 6. This elevator is also designed to handle barrels or sacks.

Figure 27 shows a suspended tray elevator for handling small packages. These packages are placed on a wooden tray, so they can be transported on a gravity conveyor. This elevator has an automatic feeding device, and is a good example of the proper way to safeguard such equipment, when it is placed in the center of a room.

Figure 27 shows a suspended tray elevator handling rolls of paper. Figure 28 shows the same type of elevator, handling trays of dishes in a restaurant. The power driven positive discharge for carrying the trays on to the table is a necessary feature in this installation. If trays were not definitely discharged, there would be considerable breakage.

Industry Illustrated

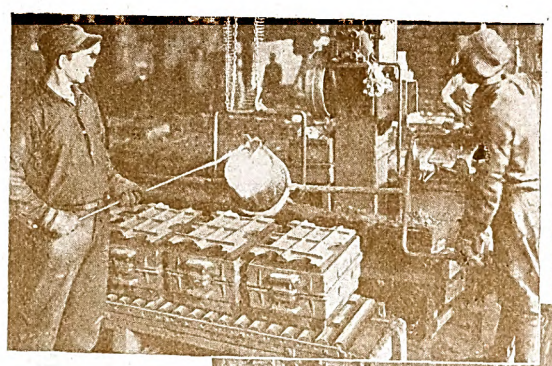
These illustrations show how the same principle of elevating can be applied to practically any industry, and for handling any size, weight, or type of package.

Simple arm elevators will receive the load only on the upper moving side of the elevator, and discharge it only over the head shaft. This is shown in figure 5. This type of elevator is recommended only for short lifts between pre-determined points of feed and discharge. Special arms have been designed for use on this type of elevator, which permits the load to be discharged on the vertical lift at various floors.

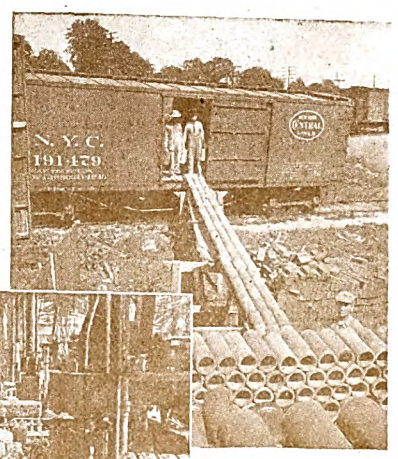
The reason for installing materials handling equipment is, as stated in previous articles, the overcoming of the present labor shortage, and the releasing of men for more productive work. If it is decided to install this equipment, the only question to decide is what type of machinery is best adapted for the work and at the same time offers the best chance of showing economies. At this point, the plant executive must use business judgment as to what constitutes an economy. In order for a machine to prove its suitability, it must not only show a profit in operation while it is busy, but the nature of the installation should be such that the machines can be kept busy a sufficient amount of time to pay a comfortable profit, and also to pay for its first, or installation costs, within a reasonable time, say from six months to a year.

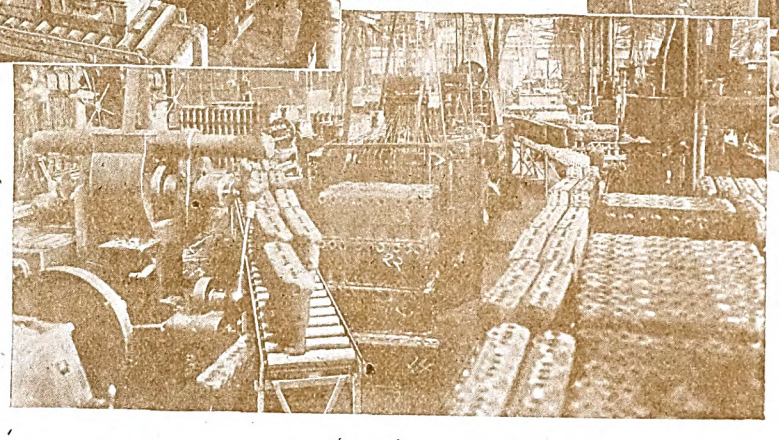
The illustrations show only the main or general types of equipment, and many installations have been made using the same principles of operation, but different design in machine construction. This would really come under the heading of special equipment, not standardized by the materials handling manufacturers, although frequently built up of standard parts. If it is necessary to design a special conveyor, or elevator, it is not difficult to obtain estimates or to find a manufacturer willing to build

(*Continued on page 53*)



The Mathews keeps materials and products on the move—into, through and out of the shop and on to the cars.





Chutes, automatic elevators, spiral and straight carriers are included in the Mathews sytems.

The Mathews carries most anything most anywhere—and saves floor space doing it.

Put Gravity to Work

The solution to a large part of your man-shortage and other operating problems is—*gravity*. Think of the abundance of this latent power about your plant. And as free as the air you breathe! Why not harness it with a Mathews Gravity Conveyer and *put it to work?*

Whether your particular problems are in the foundry, in the machine shop, in the storage yard, stock room or warehouse, in loading or unloading cars, a Mathews will put Speed and Economy into the job.

Our engineers can adapt the Mathews to *your* needs—no matter how light or heavy, or how peculiar. For there's hardly a plant layout, floor plan, production route, receiving, shipping or storage system, which cannot be fitted—*profitably!*—with a Mathews.

A knowledge of all the things that can be accomplished with this steel-ball-bearing-roller Gravity Conveyer is a liberal education to any industrial head. Write us—*today*.

Mathews Gravity Carrier Co.

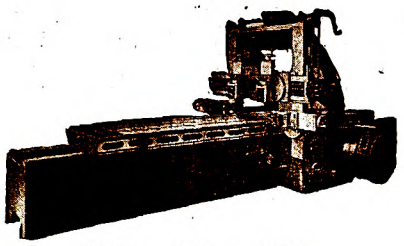
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Whitcomb Second-Belt Drive Planer

A Precision Production Machine Tool

Just one of our complete line of machine tools—Each a Leader—A Masterpiece in the Art of Machine Tool Designing and Building.

All we ask is the opportunity of laying our proposition before you

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RAPID PRODUCTION LATHES
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Branch Offices and Agents Throughout the World



CYCLONE HOISTS

HIGH SPEED

—give one man the strength of a giant

AN 80-lb. pull on the hand chain of a Cyclone Hoist will lift a ton.

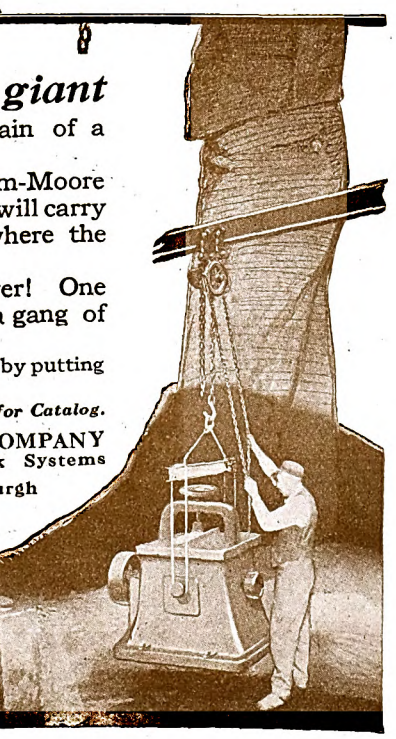
If suspended from a Chisholm-Moore "Matchless" Trolley a 14-lb. pull will carry this one ton load to any point where the overhead track leads.

Cyclone Hoists multiply man power! One man with a Cyclone can replace a gang of men using strong-arm methods.

Increase the productiveness of your men by putting Cyclone Hoist in your plant!

Built in capacities from 1 to 40 Ton. Write for Catalog.

THE CHISHOLM-MOORE MFG. COMPANY
Hoists—Cranes—Trolleys—Overhead-Track Systems
Cleveland: New York, Chicago, Pittsburgh



Distributors Everywhere



do one thing well!

THE "New-Way" could not be sold within anywhere near its price, nor made of as high quality materials and workmanship if our immense factory and skilled corps of workers did not devote their entire time, energy and ability to producing but one type and size engine.

don't be misled

It is the ideal power unit for portable conveyors of all kinds. It delivers dependable power anywhere and everywhere, and in particular, in many places where conveyors cannot be operated by an electric motor. Its use does not depend on the different kinds of electric current as does an electric motor, and it eliminates danger from high current wires. You should order your conveyor "New-Way" equipped.

If *you* have a power problem, let us help you work it out. It incurs no obligation on your part. A letter will bring our traveling engineer to your office.

Write for Circular C-23

THE "New-Way" MOTOR COMPANY
LANSING, MICHIGAN, U.S.A.

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The Air-Cooled, Multi-Purpose
"New-Way"
5 Engines in 1

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ALL these are you assured of with EBCO Bubblers placed at convenient locations throughout your plant.

Don't let production diminish or lag one particle during the hot summer days. EBCO Sanitary Fountains save wasted steps and time. No hunting for distant hydrant or water bucket. EBCO Fountains pay—in increased production.

EBCO Fountains are built solid, substantial and are surprisingly inexpensive in first cost and economical in the use of ice.

Our catalog gives complete information essential to Hot Weather Production.

May we send you a copy?

The Angle Stream is your protection against sickness and epidemic. No water can fall back into the jet spout to carry germs, and transmit them to the next drinker.

The D. A. Ebinger Sanitary Mfg. Co.

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101 Park Ave.

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258 Congress St.

EBCO BUBBLERS

KANKAKEE

ILLINOIS

The City Without a "Labor Problem"

NINE out of every ten Kankakee residents are native born Americans. The workmen are intelligent and industrious. They are free from radical unrest.

Kankakee is an open shop town. It has never known a strike or serious labor dispute. Industries plan their production with practical certainty that the plans will not be interrupted.

Kankakee is only 90 minutes from Chicago. Numerous railroads, including a belt line, offer shipping outlets in all directions. Chicago shipping rates, without Chicago congestion and delay.

Close to Chicago and Gary steel districts, Coal mined within 30 miles. Large water power possibilities. Electric power at low sliding scale rate. Plenty of good gas at reasonable cost.

Kankakee backs its natural advantages with a spirit of progressive citizenship that is welcomed by manufacturers of the aggressive type.

Kankakee Offers Industry:

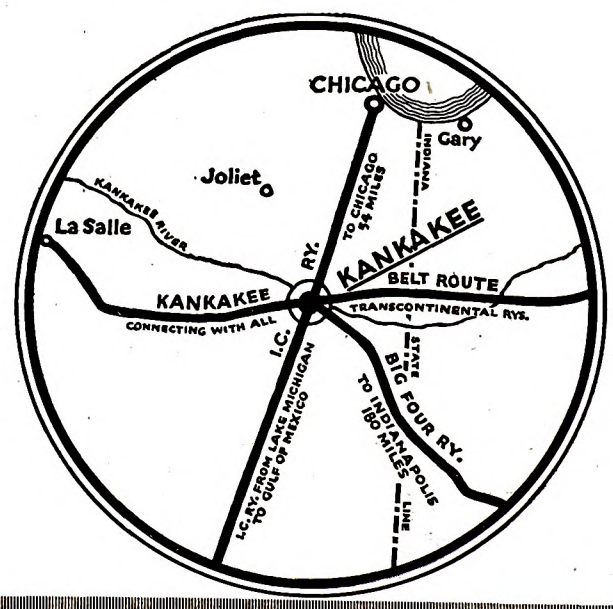
Factory sites 50% to 75% less than in cities.
Low rents and opportunity for workmen to own their own homes.
Good drinking water, modern sewage system, fresh air from Lake Michigan.
Splendid parks, golf courses, automobile roads and other recreational features.
Public and private schools of the highest type.
A surrounding area of rich farm land contributing to the permanent prosperity of the city.

Manufacturers seeking a mid-western location where every condition favors success are invited to write for further details.

J. N. Sletten, Secretary,

CHAMBER OF COMMERCE

Kankakee, Illinois.



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it, although in a number of cases, the equipment manufacturers will offer suggestions for improvements and these suggestions should be given every consideration.

What the Worker Thinks About Good-Will and Cooperation

BY RUSSELL J. WALDO

EVEN though there are scores of men clamoring at the gates of our factories begging for employment yet there is a shortage of good men, men who are capable of doing their work with the least possible loss. There is a labor problem as serious now as during the keenest labor shortage this country has ever faced. Keen and far sighted executives have expressed their opinion that good men are available and this is very true especially when one looks into the factories where men are employed and finds the vast number who are employed in occupations in which they are not adapted and finds in those occupations men working who are highly skilled in other occupations.

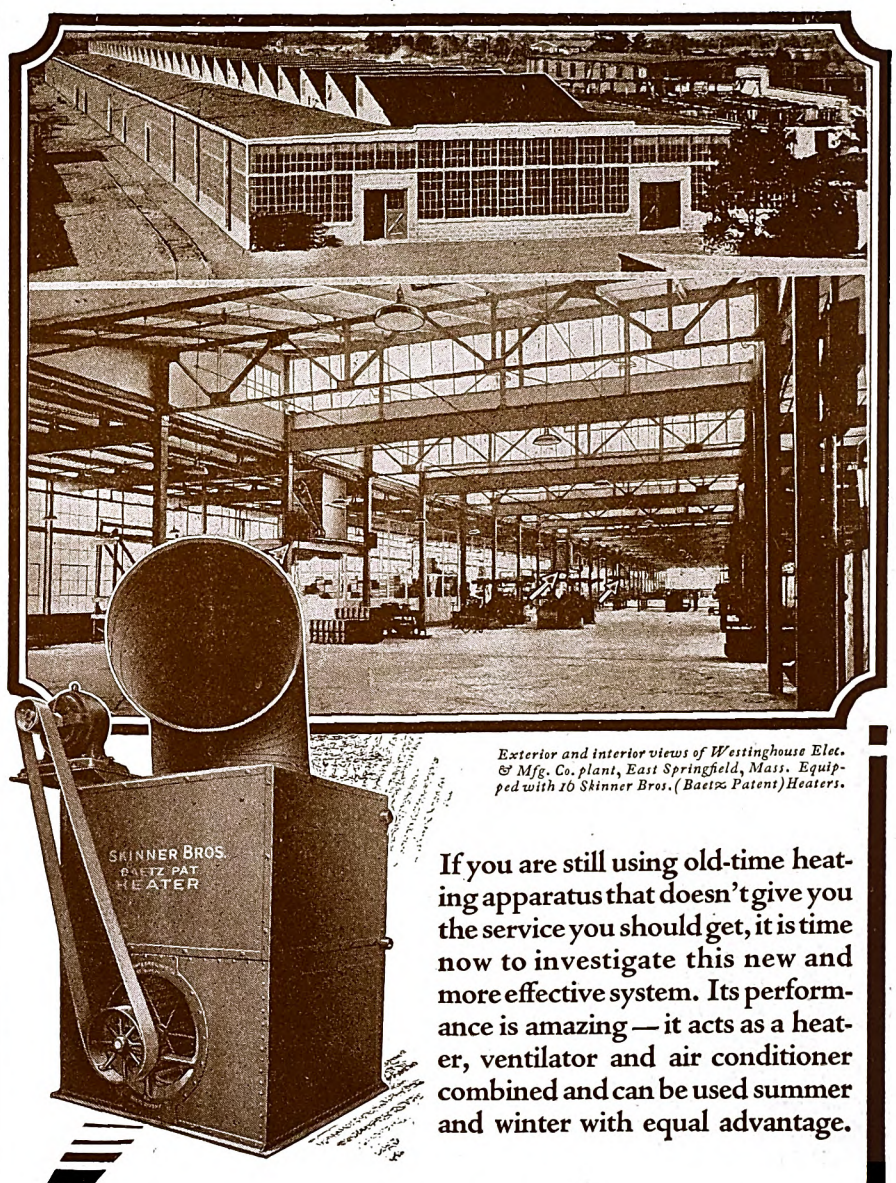
There are men who, when they gain entrance in some occupation in which they can gain some interest in their work cease to look for openings in which they are better adapted by experience and ability to fill. They are working, they are making their living and that seems to be enough for them. They are satisfied and keep moving along even though they are not doing the kind of work they are best fitted to do.

It then seems to me that the one great problem in industry today is: how shall we go about the task of directing men into the class of work they are most interested in and are best fitted by experience and ability to fill? It is a strange fact, however erroneous it may seem to many, that executives who are advertising the strongest for men have overlooked the one big opportunity they have had for the building up of their working force.

There are men calling at their offices daily asking for employment and in scores of cases they are asking for definite placement upon some particular machine or task. When a man asks for a definite place and is willing enough to come to the gates of the plant and ask for that definite place he in almost every case has sufficient experience to convince himself at least that he can hold down that job if given the opportunity. He comes having no idea that there is such a job open as he is asking for, yet is interested in that particular job.

The man who calls and asks for a definite position is usually worth more than the man who calls in answer to an advertisment calling for a man of a given qualification. It is surprising to note the difference between these two types of men and both seem to possess the same ability upon first consideration. However, closer examination will prove that there is a difference very much in favor of the man who calls when he knows there is no position open, yet hoping he may have a hearing.

There have been scores of methods tried to create closer relationship between the employer and the employee. Industrial courts have been organized, the committee system of representation has been worked out very elaborately, closed shop has been tried,



Exterior and interior views of Westinghouse Elec. & Mfg. Co. plant, East Springfield, Mass. Equipped with 16 Skinner Bros. (Baetz Patent) Heaters.

If you are still using old-time heating apparatus that doesn't give you the service you should get, it is time now to investigate this new and more effective system. Its performance is amazing — it acts as a heater, ventilator and air conditioner combined and can be used summer and winter with equal advantage.

When You Think About Heat

WHEN you think about heat for next winter consider these essential facts about the Skinner Bros. (Baetz Patent) Heater:—

1st — This heater is built on a revolutionary principle—without the use of pipes or ducts as warm air carriers it actually heats all of the open area of a factory or plant.

2nd — A simple arrangement permits the unit to be used either as a heater or ventilator or as a combination heater and ventilator. It is useful both winter and summer and therefore affords real economy.

3rd — It is so effective that it needs to be operated only a few hours morning and afternoon to keep a building comfortably warm. Utilizes live or exhaust steam at any pressure. Simple to install and operate.

4th — It is sold on a definite guarantee basis.

The Skinner Bros. (Baetz Patent) Heater is so superior to old unsatisfactory types that it has been adopted by many industrial users in the U. S., such as Ford Motor Co., Quick Meal Stove & Range Co., Federal Foundry, Castanea Paper Co., St. Louis Independent Packing Co., and others.

SEND FOR CATALOG D-9 AND LIST OF USERS

SKINNER BROS. MANUFACTURING. CO., INC.
Main Office and Factory: 1474 South Vandeventer Avenue, St. Louis, Mo.
Eastern Office and Factory: 140 Bayway, Elizabeth, N. J.

Boston, 445 Little Bldg. Buffalo, 702 Morgan Bldg. Chicago, 1703 Fischer Bldg. Cleveland, 612 Marshall Bldg.
Cincinnati, 1050 Hulbert Bldg. Oliver Schlemmer Co. Wash., D. C., 714 Evans Bldg. U. D. Seltzer Phila., Pa., 1711 Sansom St. Haynes Selling Co.
New York, 1702 Flatiron Bldg. Pittsburg, 8 Wood St. Pittsburg Heating Co. Spokane, 409 First Ave. H. B. DeLong Co. Detroit, 308 Scherer Bldg.

Skinner Bros.
***Baetz Patent* HEATING SYSTEM**

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bonus systems have been worked out and after all these have been said and done unless the worker's personal ability has been the deciding factor in the plan there has surely been a failure.

Employees everywhere are seeking to be given an opportunity to work as men and not machines. They seek that opportunity to express their real selves and not be handled as so many machines. They have minds of their own and they seek recognition of their ability.

Scores of men in every plant have good ideas which could be used to the advantage of that company if they would go about gathering that information for the benefit of the organization. So many times employees have given the foreman an idea for the improvement of the department and the foreman has taken the credit for the improvement. Men who are seeking to be promoted do not like this method. They are working to be promoted themselves and not to let some other worker profit by their special ability.

There were some enormous lessons learned during the last war. Every man, woman and child was organized to save time, effort, and material for the saving of American ideals. There was a patriotic responsibility existing then that seemed to pass out of existance directly after the war. What this country needs is wholehearted coöperation between both employer and employee. There seems to be strife on the part of both employers and employees. Each wants the best of the bargain. Which deserves the biggest share is not a question unanswered but one which has long been answered.

Both employer and employee should have income sufficient for comfortable living without requiring constant planning as to how both ends can be made to meet. The remaining profit then should go to the employer for providing the employment and as extra incentive for the responsibility which is attendant upon any enterprise.

Nearly every day we hear some one come forward with a well dressed plan for the creation of closer coöperation. When that plan is gone into thoroughly we will find that it is nothing more than the plan of some radical who is seeking to force the entrance of the organized labor or the swindling of the employer out of a large sum of money.

It is not necessary to bring in some exceedingly high priced engineer for the working out of some new plan. The writer has found it to be good policy to avoid all engineers who ask such exceedingly large rates for their service. It is true that they have spent huge sums of money to perfect their plan yet they have nothing that some keen and far sighted employee could not dig out and put into use at a much smaller figure than would be required by the former.

The time when employers believed that "give a man exactly enough to meet his existing needs and he will remain with you longer" has passed. Employers everywhere are begining to realize that if they would have the best of workmen they must pay them living wages to encourage them to stay, not the existing wage to force them to stay. Men who are forced to stay do the least possible work to get by. Men who are pro-



SOMETHING TO THINK ABOUT IN BUYING YOUR TANKS

If you are going to buy a Tank to last say ten, thirty or forty years, there are a number of very important things to be taken into consideration.

What is it to contain or store?
Liquids, water, oils, acids, solids?
Will it be outside, inside or in ground?
Should it be horizontal or vertical?
What are the weather conditions?
Is the material inflammable or combustible?
Will it be near the Plant or isolated?

These factors are brought forth because so many capable men seem to think that a Tank is only a Tank and "any old thing" that looks like a Tank will function economically.

Lancaster does not—and will not knowingly—simply sell a Tank. If a real service is to be performed and is desired by the purchaser, then Lancaster will enter into the transaction with heart and soul. Lancaster maintains that making a sale without offering the utmost in service delivered is not a good sale—both seller and buyer have been cheated.

On your next Tank requirement, put it up to Lancaster.

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Marbleloid is a *permanent* composition fireproof flooring material mixed at the factory to embody the definite properties required by its use. If in the same plant Marbleloid Floors are to be installed in an office, laboratory and work rooms, our chemists insure that the office floor will be attractive and resilient, that the laboratory floor will be warm and resistant to stains and chemical action, and that the workroom floor will be strong, non-abrasive and non-slippery.

A Marbleloid Floor has a remarkably low "per year" cost because it lasts so long and requires no painting or other expensive upkeep or repairs. The Marbleloid Company manufactures, installs and guarantees each floor. *If you are thinking of a new building or of replacing an old floor fill in the coupon below and receive definite information.*

THE MARBLELOID COMPANY, 467 Eighth Ave., New York

THE MARBLELOID COMPANY, New York City: Without obligating myself in any way, please submit tentative estimates on the cost of your product installed complete for our building.....: below are the approximate areas involved.
Floor.....Sq. Ft. Sanitary Base.....
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vided a living wage and proper environment to work in, work to the interest of the company rather than their own lazy interests.

It is true that employees have been humored for the past few years and have been spoiled like the little boys often are. However, this can not be cut off completely at once without thoroughly and completely educating the workers as to the reasons, and educating them in the better management of their affairs. This can all be done with no increase in the personnel of the organization or the suffering of the workers or their families. The worker is mightily interested in the welfare of his family and he must see how he can provide for them. If his wages must be reduced he must see where he is coming out even, at least until prices come down. Prices have not come down to a very large degree, yet they have come down some and must come down more.

There are some measures of buying for workers in large quantities which have attained remarkable success and have been fully appreciated by the workers themselves. It is such as these which help hold the workers together at no added cost to the employer.

Coöperation must be obtained from the office boy to the superintendent and when obtained must be held firmly if ever industry expects to come out of the present chaotic state in which it now is.

THERE is no definite size to which coal must be ground for use in powdered coal burning plants, although it is recommended, generally, that 95 per cent of the pulverized coal should pass through a sieve with 100 meshes to the inch and 80 to 85 per cent through a sieve with 200 meshes to the inch, states John Blizard, fuel engineer of the Department of the Interior in Bulletin 217, just issued by the Bureau of Mines. It has been found possible to operate some furnaces with coaser coal, and found necessary for firing open-hearth furnaces to grind the coad more finely. The more finely the coal is ground the more rapidly will it burn, and the more readily will the smaller ash particles pass off with the gas.

Do your Temperature Curves run

Zig-zag, like this?

or

Straight, like This?

Although you may *think* you are getting uniform temperatures in important processes involving the use of heat, you would probably be amazed if you could see the wide fluctuations that result from so-called hand "regulation."

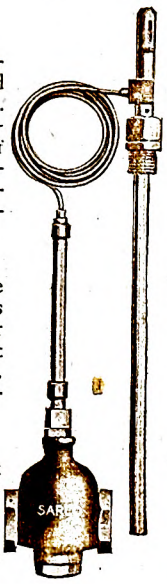
The zig-zagging of temperature usually means waste of ingredients, spoiling the finished product, or lowering of quality of the goods which means undermining your reputation. These conditions are permanently corrected by using the

SARCO
Temperature Regulator

No human hand can begin to compete with the Sarco. Responding instantly to the slightest temperature changes, it automatically admits or shuts off the steam, preventing excessive variations. Once set for a given temperature, *it maintains that temperature.*

The Sarco is entirely self-contained and self-operated. No electricity, compressed air, water or other outside agencies required, consequently it costs nothing to operate.

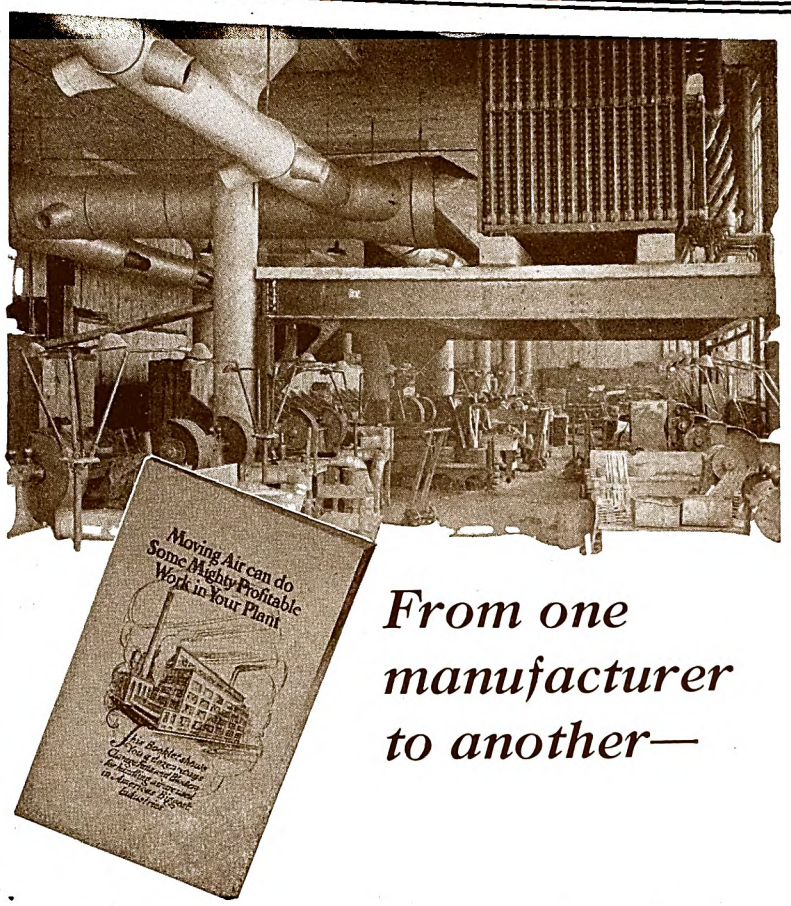
Has no perishable parts. No weights or levers to tamper with and throw it out of calibration. Not affected by temperature of room.



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From one manufacturer to another—

There is a human tendency to take our own advice first and the other fellow's afterward—and we confess that in our own plant here in Kalamazoo this tendency has more than once been the reason for passing up equipment and methods which, when they were finally forced on us, seemed indispensable.

One thing, however, has forcibly brought home to us the error of our ways—experience with *other* manufacturers who failed to see the possibilities of our equipment—the great saving of air conveyors for handling hundreds of raw materials.

And it was because we realized from our own experience the tendency for most organizations to become too self-centered, and as a result overlook real labor and money saving opportunities, that we compiled a boiled down book illustrating a number of the highly profitable uses of moving air. It shows clearly the more common uses—and to the alert executive it will suggest many other similar applications.

We know that hundreds of plants can profit by utilizing the great power of moving air—but we are not suprised, knowing that human tendency, that they are skeptical about it. We merely ask that men responsible for reducing and keeping down operating cost give this book an open-minded hearing. Surely any good executive is willing to do that!

Clarage Kalamazoo

CLARAGE

FANS~BLOWERS~EXHAUSTERS

KALAMAZOO

Clarage Fans are built in types and sizes for every service.

Assembling Fordson Tractors "On the Move"

(*Continued from page 26*)

of the final assembly lines, which are in reality the keys or indices to production.

On the first motor assembly line, the crankshaft and camshaft are fitted. After the bearing caps have been tightened down on the camshafts they stop at the burning-in machines where from fifteen to twenty seconds of running in produces a finished bearing job said to be even better than that which could be secured by scraping.

With this work completed, the cylinder is returned to the second line where the pistons, connecting rods, valves, springs, magneto, etc., are assembled. A minor conveyor line shown in one of our pictures is used for the preparation of the piston unit assembly which comprises pistons, rods, rings and pins.

The completed motor blocks are again run in on a battery of motor-operated machines to assure smooth running and to indicate the existence of friction prior to the final assembly of the tractor.

While work on the motors has been progressing, similar progress has been made on the rear axles and transmission housings. These are assembled step by step by gangs of men stationed at either side of the assembly lines, each man having some specific operation to perform on each unit as it comes to him. Most of these operations have been split into their simplest possible components, so that skill is acquired in performing them in the least possible time. Naturally some operations require more skill than others and thus on the more difficult ones are found the more experienced and higher paid operators. Some of these men develop an almost uncanny sense of touch or sight so that they can detect irregularities and dimensions that would usually be made apparent only at the careful micrometer measurement. One of these operators, for example, has specialized for a number of years in inspecting crankshaft bearings after the burning-in process and in applying the necessary laminated shims. This operator can tell after one glance at a bearing and its cap the exact number of shims required to set the bearing to its running condition.

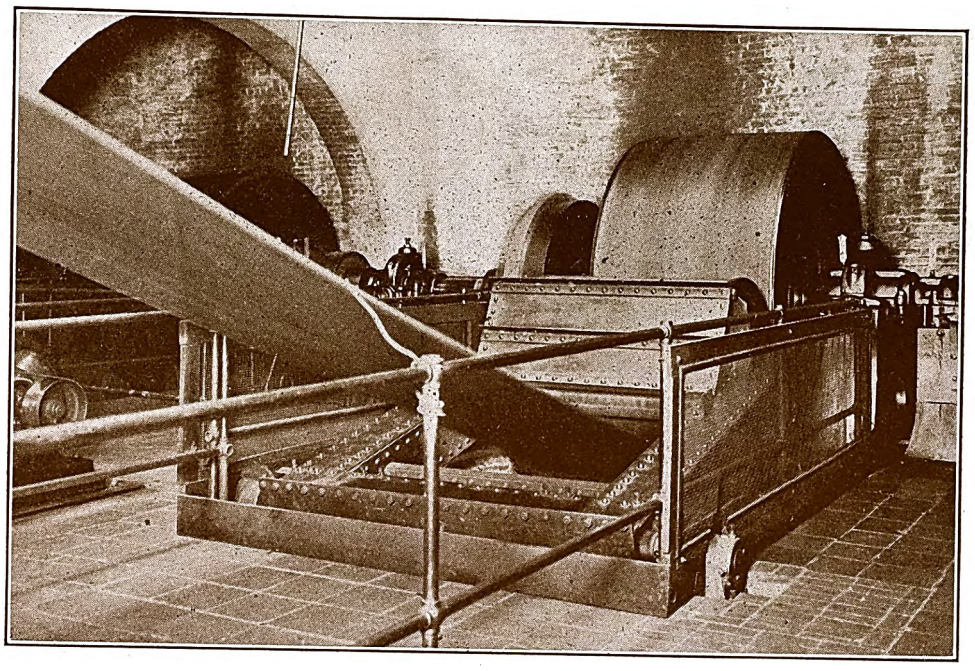
There has been a good deal said about the monotony of such highly specialized work as that of these assembly lines. There are some operators at River Rouge who like to change from one job to another; there are others who are exactly opposite in this respect. After an operator has spent a reasonable amount of time at any job in the line if he desires a change for the sake of variety it is usually arranged. Various operations of course require different physical characteristics, some strength, some quickness, etc. In the assignment of new men to the lines these requirements are very carefully kept in mind.

The most fascinating part of the assembly line is that where the completely assembled tractors descend from the conveyor rail. At the present rate of production they come off at the rate of one every one and two-fifths minutes. While the last operations in assembly are being performed the radiator has been filled, and "gas" oil deposited in the tanks. When each tractor comes off the line, therefore, it is ready to run. A tester jumps into the driver's seat and adjusts the spark and throttle control, while at the same time the "starter"—another operator—has brought into position in front of the tractor a swinging, electrical cranking arm which grasps the crankshaft extension and at press of a button spins the motor. Almost invariably they start after the first revolution or two. In driving them under their own power to the paint line the testers are able to determine if any adjustments are required and to make them.

Painting is also performed "on the move" with specialists, each assigned to cover a certain area or part. Two colors are used: red for the wheels and gray for the remaining parts of the tractor.

(*Continued on page 58*)

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Point Number One—"Arc of Contact"

SEVERAL FACTORS must be taken into consideration in planning a belt drive to insure its successful operation. The most important of these is the *arc of contact* between the belt and pulleys.

An arc of contact sufficient to transmit the load may be obtained by two methods:

Natural—by the use of long pulley centers and slack belts, involving a large amount of floor space

Artificial—by the use of tension idlers or idlers of the flexible, resilient type when acting as belt wrapping devices, such as

THE LENIX DRIVE

A lack of floor space may prevent the use of the natural means. Where the necessary floor space *is* available it is expensive to use it for the purpose of giving long pulley centers to a belt drive. The disadvantages of the tension idler offset the benefit obtained through the slightly increased arc of contact it creates.

For eighteen years we have been building the "belt wrapping" LENIX DRIVE and are the pioneer manufacturers in this country of this type of drive.

At the plant of a brick manufacturer in New Jersey, a 1400 HP Corliss engine could not deliver more than 900 HP because, through lack of sufficient arc of contact, the belt would not hold on the lineshaft pulley when the load was raised about 900 HP.

A Lenix drive was installed and, as illustrated, is wrapping the 50", three-ply belt around practically three-fourths of the circumference of the lineshaft pulley, and the engine is now delivering its full capacity.

Booklet "Saving Slippage and Space" tells how it is done.

How belt tension is reduced, rather than increased, by the Lenix will be told next month under "Point Number Two."

FIVE POINTS

1—The Lenix increases the arc of contact between belt and pulley.

2—The Lenix maintains constantly and accurately the proper tension in the slack side of the belt.

3—The Lenix saves floor space, building space and belting because of freedom in pulley locations.

4—The Lenix saves in bearing friction, lubrication and renewal of bearings because of reduced bearing pressure.

5—The Lenix permits the use of less expensive, high speed and high efficiency motors or generators because of the higher pulley ratios.

F. L. SMIDTH & CO.

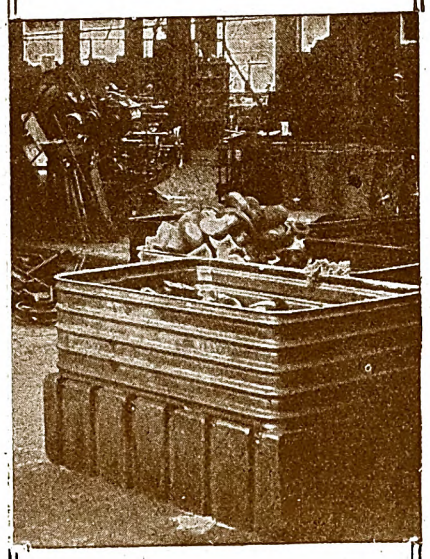
ENGINEERS

50 Church Street **New York, N. Y.**

THE LENIX DRIVE

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TRUSCON PLATFORMS
ALLOY STEEL



Save Time and Labor In Handling Materials

Not to use a modern system of conveying and handling materials is a great waste. Whenever anything is placed on the floor it has to be picked up again, which costs money. Instead, it should be placed on a Truscon platform and then it is all ready to be moved without further handling. Either hand, or power-lift trucks may be used.

Standard Size of Truscon Platforms

Clear heights (inside): 6½", 7½", 9½", 10½", 11½", 12".
Over-all widths (outside): 24", 30", 36", 42", 48".
Clear widths (inside): 2¼" less than over-all widths.
Lengths: 24", 30", 36", 42", 48", 54", 60", 66", 72".
Other sizes to meet special requirements.
Indicate quantity, length, width, clearance height and width of truck.
Attached stakeholders, handles, etc., provided if ordered. Boxes, skeleton frames, end pieces, etc., also furnished.

For small objects or loose materials, Truscon Steel Boxes are used with platforms. We furnish practically any kind or size of steel box for handling materials, Truscon Steel Boxes are conveyors, cranes, etc.

Truscon Steel Boxes Skeleton Boxes for Steel Platforms

Furnished in 12", 18" and 24" depths. Either welded securely to the platform or equipped with steel stakes which slide into ribs of platform. Boxes may be stacked to any height.

Steel boxes of all kinds and sizes for handling materials and products. Tell us your requirements and your method of conveying. We will furnish you practical suggestions, estimates, etc.

Truscon Steel Company
YOUNGSTOWN, OHIO
Sales Offices in Principal Cities

(Continued from page 56)

The supply of paint is contained in tanks which are built along the sides of the painting line over which the tractors are drawn by chain conveyors.

Descending from the paint line the completed tractors are driven to the parking spaces where they are allowed to dry and thence to the box cars in which they are shipped. Thus ends a most interesting process of integrated manufacture as examplified at River Rouge.

FIREMAN JOE

By James T. Beard, 2nd

There is Fireman Joe; he's the busiest man
For he watches his gages and throttles his fan
And he keeps all the heat of the coal that he can
From the stack.

And there's B. T. U. Cole and C. O. Toogass
They are friends of Old Joe, but they sure have the brass
For they asked the Old Man to give them a pass
To the stack.

Now C. O. Toogass is a worthy old soul
He is not full of mischief like B. T. U. Cole
So they gave him a pass and he leisurely stole
Up the stack.

Then B. T. U. Cole got pretty darn sore
He fussed and he argued; he cussed and he swore
And one day he jumped with a terrible roar
Toward the stack.

But Pyrometer Bill was awake at his post
And saw him go by like a vanishing ghost
And as he sped on he flung back a boast
From the stack.

Then Pyrometer Bill got busy right quick
And telegraphed Joe about the mean trick
How B. T. U. Cole tried to climb up the brick
In the stack.

Then Fireman Joe shut the damper a crack.
"Now I can't let you out to the big roomy stack.
For, once you get out, I can't get you back
From the stack,"

Said Fireman Joe; he's the busiest man
As he watches his gages and throttles the fan
For he keeps all the heat of the coal that he can
From the stack.

THE SEAT OF
Production



No. FS-22, Patented.
Adjustable Legs and Back-Rest

The value of "Royal-Chicago" Chairs is not represented by the cost of so much steel, wood, and labor, but by the increase in efficiency and loyalty for which they are responsible.

Royal Metal Mfg. Co. 2312-14 S. Western Ave., Chicago, Ill.

"Royal-Chicago" PRODUCTS
THE CORRECT INDUSTRIAL SEATING

Steam Generation at 3200 pounds!

Will wonders never cease—

This, from England, is the latest steam pressure proposed and a station will be built to operate at this pressure. First 600 lbs. sounded feasible, 900 lbs. doubtful until 1200 lbs. was put into operation and now 1500 and 3200 lbs. are proposed. How the steam world do move!

As one engineer put it, "Anything to get more out of a pound of coal and the sooner the better."

These steam pressures may be just in the offing but the present problem of the practical steam engineer is to do everything possible to assure himself that coal is not being wasted unnecessarily.

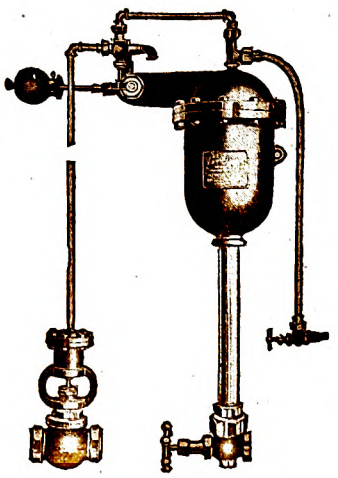
And many companies have found that they can do this by installing Vigilant Feed Water Regulators which keep the water level constantly within one-quarter inch of center gauge regardless of load or method of firing.

For the highest overall operating economies — you need a steady water level at all loads; you need a Vigilant Feed Water Regulator. The first step is to find out, without obligation on your part, what the Vigilant will do for you. The second step is to

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VIGILANT Feed Water Regulator



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The Executive's Greeting to Callers

BY HELEN HYSELL

TOO often, the business executive who believes implicitly in the indelible quality of first impressions is concerned mainly with his own first impressions of the caller. The "approach" as he sees it, is onesided—not because he thinks only of himself but because he has not thought at all.

If one may judge by the elevator employees, reception clerks and office boys one meets between the street entrance and the door of the private office, the majority of executives are an extremely short-sighted group of men. And, unfortunately for all concerned, the impression the caller makes upon the executive is good or bad, according to the impression the executive has made upon the caller on that long and frequently embarrassing trip to the private office.

He sits at his desk, this impressionable executive, waiting to be impressed by the caller whose name the reception clerk did not repeat correctly over the telephone. His eyes are on the door as he wonders what Smith from Smytheton wants; how hard it will be to get rid of him; whether he'll offer a cigar; talk about the weather; wear spats; or try to sell insurance. And his facial expression is caught and remembered by Mr. Smythe from Smithfield who has come as a representative of a concern with which the executive has had much correspondence. Mr. Smythe is already annoyed because the beautiful—but dumb—reception clerk has mixed his name with the name of his town and omitted entirely to state the business on which he has come.

This annoyance is reflected in the stiff smile with which he greets the executive whom he wished to approach with an open mind. It shows in the tone of his voice, in the way he crosses the room and in the half-hearted grip of his hand. He has approached the executive with an open mind and, whether he wills it or not, Mr. Smythe from Smithfield is disappointed and his mind closes automatically. He may marshal his faculties quickly and dispatch his business without preamble. Or he may take up half an hour of the executive's time before he recovers his poise. But his mind remains closed throughout the interview and also throughout future interviews, if any.

The executive is conscious only of the unfavorable impression the caller has made upon him. He has granted an audience and put himself into a receptive mood. True, he was a bit doubtful as to his caller's name and business and, naturally, curious as to what was coming. But that wasn't his fault. He hadn't known it was Smythe and not Smith but he had made an effort to be gracious the moment he found out. He was particularly anxious to be pleasant to the fellow because of a favor he planned to ask of Smythe's firm. Smythe hadn't given him a chance to be pleasant. He was grouchy like most of the other chaps who came into the office.

From this point the executive is likely to wonder why all this talk about the "psychology of the approach" hasn't had any effect. He reflects upon the oddity that scarcely one person in fifty really acquires a pleasing approach. If he is a purchasing agent and his callers are salesmen, this puzzled executive will also wonder how a fellow "with a perpetual grouch" ever sells anybody anything and he will be frowning at the door through which the next salesman must enter, even as he wonders.

If he is one of those purchasing agents who waited long hours in the outer offices of sales concerns during the hectic catch-as-catch-can years of war-time sellers' market, he

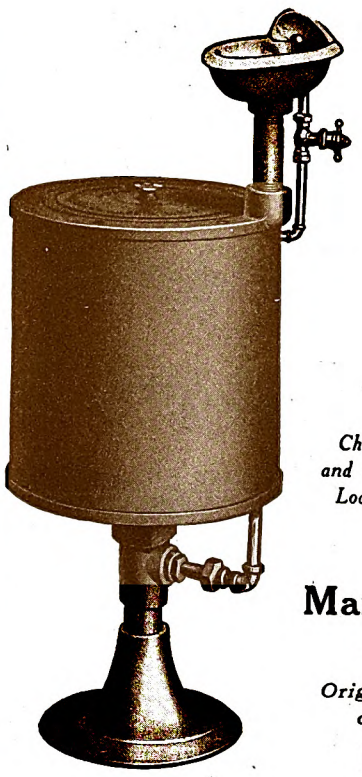
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Practical, Tangible Assets in the Modern Factory

We guarantee their durability and efficiency.

Let us send you proof of their economy in both first cost and operation.



Chairs and Stools Lockers

METAL MEECO PRODUCTS

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Originators and World's Largest Makers of Ice-Cooled Drinking Fountains

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MEECO COOLERS

Mechanical Draft

Regardless of the size or the requirements of your power plant, American Blower equipment of proper design is available. We offer a complete cooperative engineering service as well as the equipment of proven efficiency.

Write for Bulletins

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FOR HEATING, VENTILATING, DRYING, AIR CONDITIONING, MECHANICAL DRAFT

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may remember the pretty little girl who snubbed him so unmercifully one day back in 1920; or the superior office boy who condescended to tell him that "the boss's got no time for buyers or pedlers"; or the sub-assistant something or other who stood snobbishly between him and the official he had traveled two hundred miles to see. If he has fought desperately to keep his temper in the face of irritating rudenesses, neglect and indifference on the part of various minor employees while trying to get an audience with the correct representative of an essential war-time source of supply and remembers the failure of that attempt, it may occur to him to wonder "Why the grouch."

It may even occur to him to swallow his pride at the first indication of pettishness or stiffness on the part of salesmen and proceed to take a look at conditions outside his door. He should know, without being told, that his "approach" is wrong but the realization of this fact may not come into his conscious mind immediately unless he forces himself to ask "why" the change in the salesman's "approach" and to ask this question of the salesman himself.

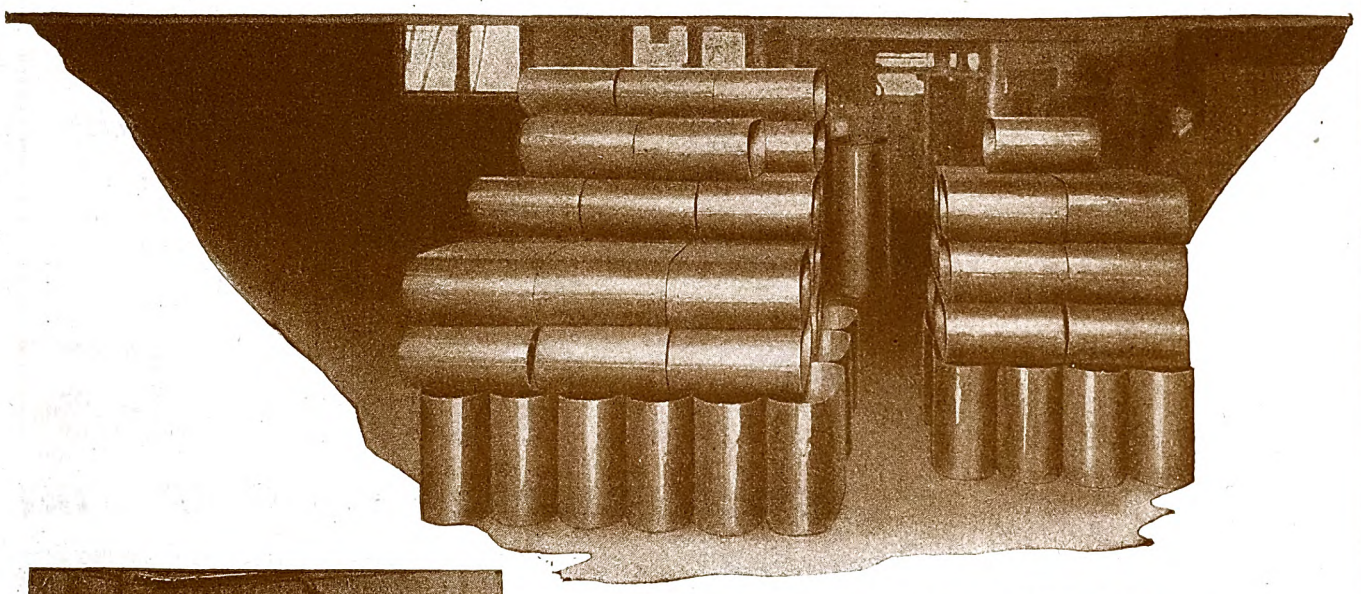
This much discussed "approach" has been and still is both under and over-rated in its importance to modern business relations. In one way or another it has come to be applied almost exclusively to salesmanship. It is the salesman who is assumed to depend upon making a good first impression, a pleasing approach. And it is his personality that has come to constitute his approach in the majority of minds—including his own. And it is in salesmanship that the importance of the "approach" has been so much over-rated.

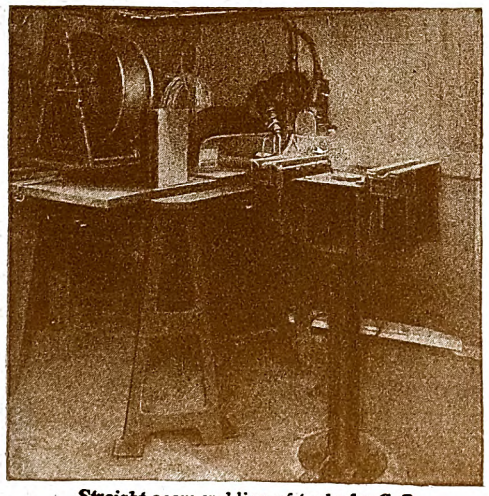
There can be no doubt that, all other things being equal, the salesman stands or falls by means of his personality. But all other things are seldom equal. And, in the final analysis, it isn't the so-called personal impression that counts so much as it is the intangible, beyond-self atmosphere of efficiency, honesty and desire to be of real service.

The average purchasing agent has far too many different brands of different materials to consider for him to know each one as completely as the salesman knows it—or should know it. And it isn't the wave of personal liking so much as it is the undercurrent of good will and friendly feeli aroused by the salesman that makes the purchasing agent stop, look and listen. It is not the manner of approach that the purchasing agent buys. It is the material. And he buys the material because the salesman has succeeded in showing him that it is what he wants. The salesman who understands that the modern purchasing agent looks upon him and his clan as advisors rather than pests and succeeds in "putting over" his desire to give honest advice and council whether he gets an order or not, has acquired the best possible "approach" regardless of the purchasing agent's personal feeling for that salesman's smile, his hand clasp or his brand of cigars.

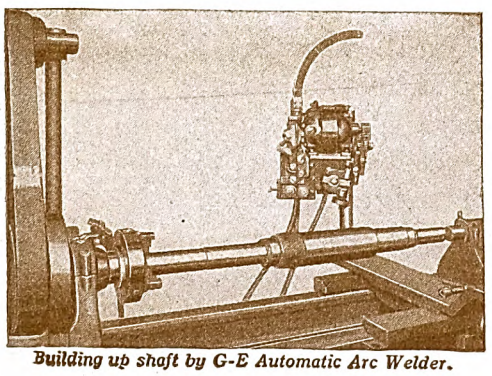
A natural, man to man manner is infinitely preferable to the mechanical pleasantness that creaks of "stage busi-

Where Speed Shows Better Results





Straight seam welding of tanks by G-E Automatic Arc Welder.



Building up shaft by G-E Automatic Arc Welder.

Automatic Arc Welding

The above picture shows 50 tanks welded by a G-E Automatic Arc Welder in a half day, as compared to 21 tanks welded by the hand method in a full day. The metal welded is 1/8" thick by 24" long.

Through this automatic application of the electric arc, a steadiness of the electrical conditions in the arc is obtained and maintained, resulting in a uniform and high quality of weld—and higher speed. Higher welding speeds produce lower welding costs.

The principal field for the G-E Automatic Arc Welder is the production, by welding, of duplicate objects in considerable quantities.

Its greatest use is for straight line seam, which is the simplest form of weld—but it also does efficient welding of circular seams, and in building up processes on metal.

G-E welding engineers will cooperate with you in making suitable applications of the Automatic Arc Welder to processes of production in your plant. Ask them.

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ness." If this manner is pleasing, so much the better. We all enjoy meeting likeable people. But we don't like sunshine filtered through dirty windows and that is what the artificial personality amounts to in many cases.

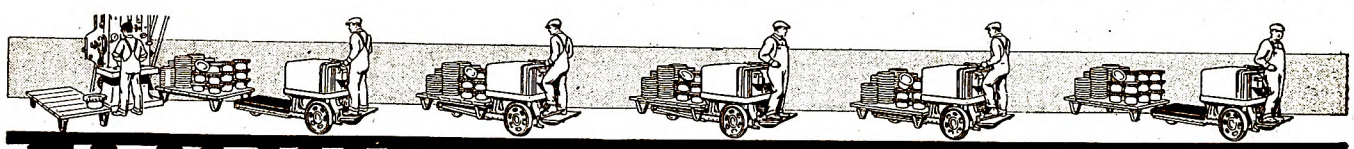
An artificial personality that makes a pleasing impression upon one purchasing agent may have the opposite effect upon another. And yet, the one who is pleased is no more likely to buy than the other unless the salesman has so presented his facts that his product "goes over." It is frequently difficult to tell where the artificiality ends and the honest statement of facts begins, and purchasing agents are notorious for their habit of "playing safe." Trained judges of men as well as of markets and materials, they will lend an ear to naturalness whether it is markedly pleasing or not and they will believe, without question, statements that would be laughed at if the salesman's manner of approach were of the artificial variety.

The approach, as it pertains to the personal charm radiated by the salesman has been, and still is, much over-rated. As it pertains to the simple courtesies extended to the caller by the employees who stand between the caller and the man he wishes to see, the approach is, and in too many cases always will be, much underrated. Even the unpleasant experience of finding himself in the other man's place— an experience through which every executive has passed at least once and the majority of them, many times—has not hammered home the truism that there are two sides to every question. The executive continues to sit behind his desk and to be impressed without once wondering if that thing called "approach" is printed on both sides of the ticket.

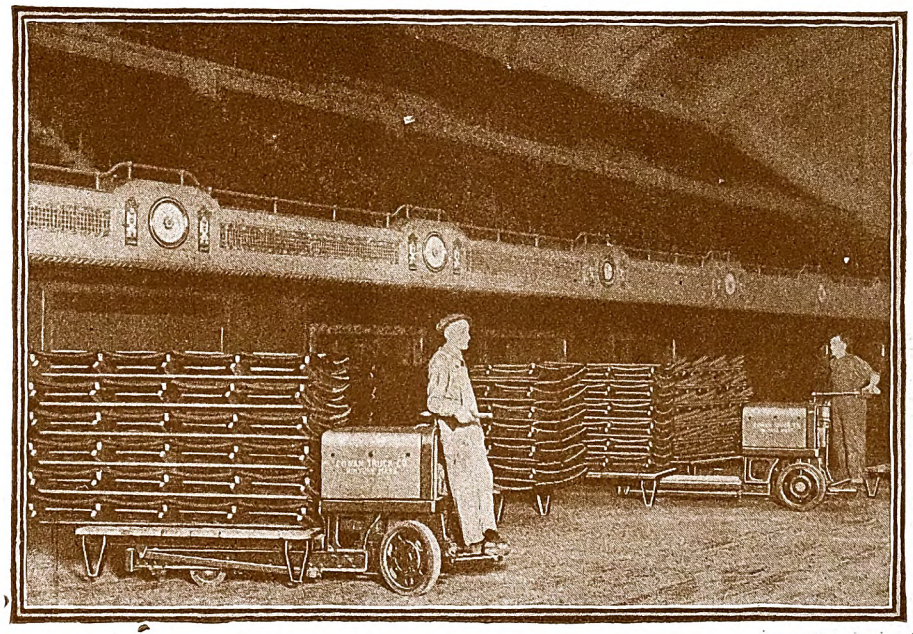
In some instances, the executive approach begins with the outside door. Not so long ago, an important deal fell through because an elevator starter allowed a caller to get into an express elevator and the operator, obeying orders to the letter, refused to stop at the desired floor. The caller was himself an executive of quick temper and high-handed methods. He objected to being carried to the top of the elevator shaft and back again to the bottom and he said so in a manner that invited insolence from the girl elevator operator and a curt denial of error from the starter who, knowing where the caller wished to go, had allowed him to get into the wrong car. The bad impression so created sent the irate caller hurrying back to his own office where he dictated a letter that closed, for all time, the channel of communication between the two concerns.

But did it occur to the executive who received the letter to investigate the charges made against his "approach"? It did not. The elevator starter was not cautioned to attend more carefully to his job. The operator was not scolded for her insolence nor drilled in common courtesy. And the executive assumed an air of injured innocence whenever the quick tempered caller was mentioned in his presence.

The slogan "our callers are always right" might well be emblazoned on the walls of

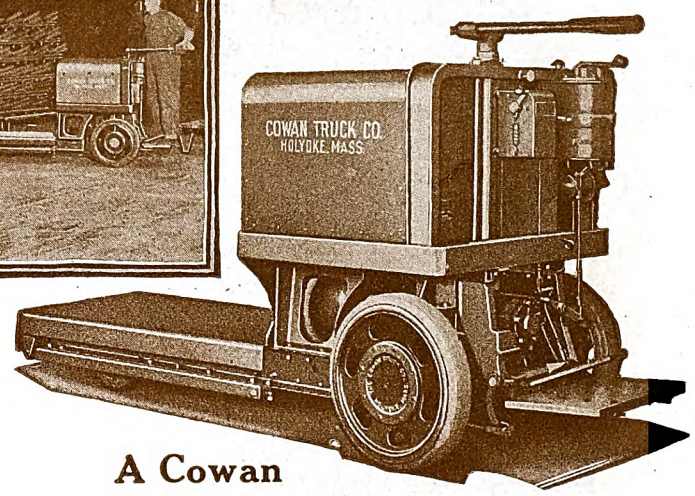


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Cleveland's new $6,500,000 Public Auditorium, where two Cowan Electric Lift Trucks and one hundred Cowan Skid Platforms are used to eliminate rehandling of removable seats.



A Cowan Electric Lift Truck

EVERYWHERE, executives concerned with material handling problems and rapidly rising costs are turning to the relief and economies offered by the Cowan Electric Lift Truck and Skid System.

Through this efficient Cowan System for eliminating rehandling of material, a prominent Pennsylvania manufacturer has released twenty-two men for other work and effected savings due to quicker delivery and increased "turnover."

Cowan Lift Trucks and an adequate number of Cowan Long-Life Skids can be effectively and profitably applied to your particular problem. Write us for complete information.



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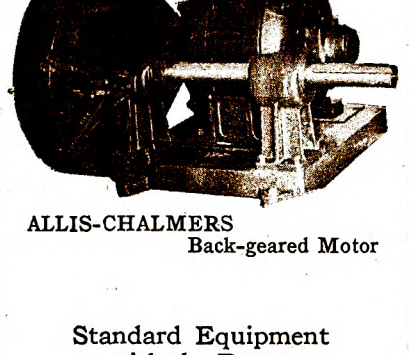
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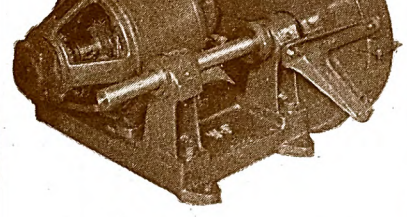
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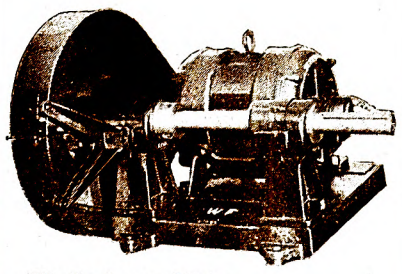
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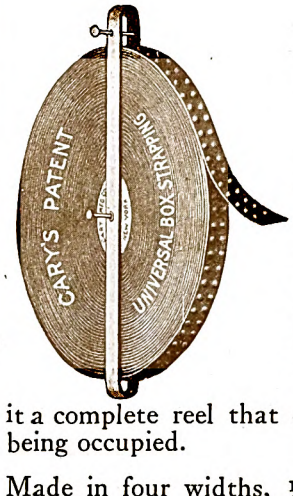
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every office just as "our customers are always right" is fixed in the minds of many organizations that depend upon satisfied customers for business success. Tactless handling of callers reflects upon all departments of business management. A "no admittance" sign upon the factory door is usually accompanied by some indication as to where the office may be found and does not reflect upon the management. But a "no admittance" expression upon the face of a reception clerk may easily be taken as a gauge of the executive attitude toward callers.

Practically all callers who enter the outer office are prepared to state their names and business. The majority of these callers present their cards to the clerk who receives them even before they specify the executive's name or title. Others, having discovered that the majority of reception clerks either cannot or will not read what is before their eyes, prefer to tell their names in the hope that errors in pronunciation may be avoided. A few—and the number will grow less as the standard of receiving callers is raised—refused flatly to tell anything but the name or title of the man they wish to see.

It speaks well for the optimistic temperament of business men—and especially of salesmen—that this latter number does not exceed the two preceding. The empty-headed, indifferent, frequently inaccurate and almost always preoccupied girl chosen by so many firms as a reception clerk is enough to cause the caller to abandon hope entirely. And the swaggering, self-important, insultingly condescending small boy or his older edition, the over-groomed and underbred young dandy are even worse. Too, there is the odd-jobs clerk whose duties are many and whose manner is flurried. The caller usually has to wait until this clerk finishes a task before he is noticed at all. And while he waits, he is subjected to the embarrassing fire of many pairs of eyes, eyes that are curious, eyes that are or seem to be amused and eyes that are merely weary of looking at work and rove from the clock to the caller and back again to the clock.



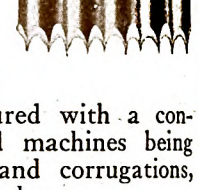
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UNIVERSAL BOX STRAPPING
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as the standard for quality and strength.

This strapping is made of extra soft annealed steel of great tensile strength. Nails can be driven through it without first punching holes. The nail heads are protected, when case is moved along the floor, by the raised bosses which strengthen the edge of the strap. Every coil is equipped with our Patent Metal Hanger which makes it a complete reel that can be hung anywhere without floor space being occupied.

Made in four widths, ½, ⅝, ¾ and 1 inch. Put up in coils of 300 feet; 20 coils packed in a case.

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SAW EDGE JOINT FASTENERS



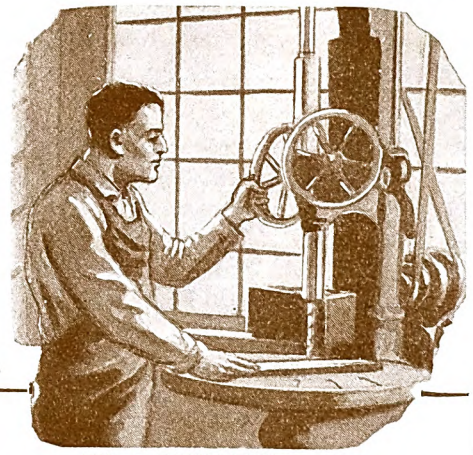
CARY'S Continuous Cutting Edge Saw Tooth Fasteners are made of the best quality Cold Rolled Strip Steel, insuring a perfect fastener that will not bend while driving. You will not find fractures between the corrugations. Special effort is made to have corrugations uniform so that they have equal drawing strength.

These fasteners are the only fasteners manufactured with a continuous cutting edge, the patents, process and machines being owned by ourselves. Made in various widths and corrugations, also in coils wound right and left. Write for samples.

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We wish to state that we are very much pleased with our use of "BLU-EE" and find that it eliminates the glare without the necessity of placing window shades.
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We use BLU-EE on our windows to minimize the sunlight, and it answers the purpose splendidly, without keeping out the breeze; whereas, Awnings would cost considerably more and keep out the breeze.
AMERICAN SNUFF CO.,
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INCREASES PRODUCTION
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Cooler workrooms and better light help to increase production during the hot summer months. You can protect your workrooms from the glare and heat of the hot summer's sun without expensive awnings or shades by coating your windows with BLU-EE.

BLU-EE is easily applied; simply dissolve in hot water, allow to cool and apply to the windows with a paint brush. It will not rub off but can be easily removed with warm water.

We want to prove what BLU-EE can do in your plant. Try some at our risk. Fill in the coupon below and send it in at once.

PARK CHEMICAL COMPANY
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Try It Out—We Run the Risk

PLEASE send me 2 packages of BLU-EE, sufficient to cover 2000 square feet of glass. It is understood that I am to use one of the packages as directed and will remit $5.00 for both if I am satisfied with BLU-EE, and if not entirely satisfied may return the other within thirty days and you will cancel this order.

Firm Name..... Position .....
Your Name..... Address .....

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It is rare, even today when every man is recognized as a potential psychologist, to find an intelligent young woman an understanding fourteen-year-old boy or a young man of the alert, I-may-be-calling-on-an-executive-sometime sort. Such an "approach" from the executive viewpoint is too expensive. Intelligence means higher salaries than the position is worth. Thousands of dollars are spent in a month for solid mahogony and plush carpets to make the executive's offices attractive but a few hundred a year is considered sufficient to employ a clerk to receive the caller who enters one of these resplendent offices. And nothing beyond a low fence and a few hard chairs is purchased for the reception room in which the caller must wait.

When, on rare occasions, a person of intelligence is found as a go-between, the caller is quick to respond with full information about himself and quite willing to wait until the executive is free to see him. Even when the reception room is a part of the main office he does not notice the battery of eyes, the rattle of adding and typewriting machines or the discomfort of the chairs. Once admitted to the private office after being courteously and intelligently received, he is more than ready to put his best foot foremost and even to overlook an incivility on the part of the executive. If he has come to register a complaint, he will be much more willing to accept apologies, explanations and adjustments if the executive's approach by way of the outer office has been pleasing.

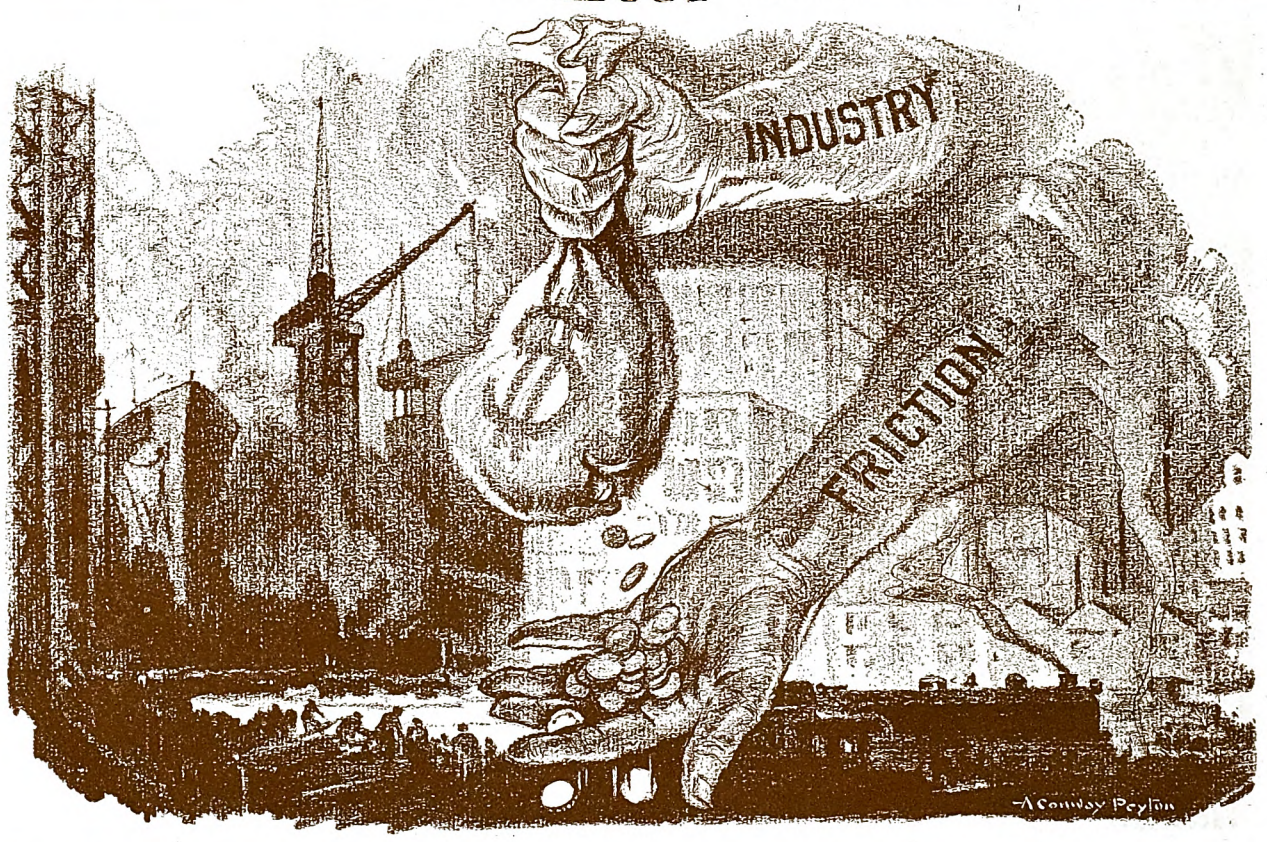
If the caller is a salesman who has been saving an especially good proposition for some purchasing agent whose "approach" is by the way of large orders, the purchasing agent whose go-between has impressed the salesman pleasantly is likely to hear about it.

Whatever the caller's reason for calling, his manner of approaching the executive will, inevitably, be colored by the manner in which the executive has approached him. He will make a good impression or a bad one, this caller, according to the impression he has gained on his way to the private office.

The caller with the perpetual grouch or, what is more likely to be the case, the perpetually grouchy callers should make the observant executive sit up and take notice of his own doorstep. It isn't reasonable to suppose that human nature has changed just to spite the man behind the desk any more than it is reasonable to suppose that the average executive is one-tenth as unpleasant as his "approach" would lead one to believe. Yet there are a great many, executives who have never discovered the difference between private office courtesy and general office courtesy and who blame everything that happens upon the change in human nature.

The sooner the man behind the desk awakes to the importance of his "approach" and realizes that the one-sidedness —if it is one-sided—is in the line of a circle from the outer door to his desk and back again to his outer door, the sooner he will find his perpetually grouchy callers turned into perennially cheerful givers of that good will and friendly feeling which is the prime essential of business.

Made Under SKF Supervision



Ball-Bearings Help Stop Friction's Drain on the Profits of Your Plant

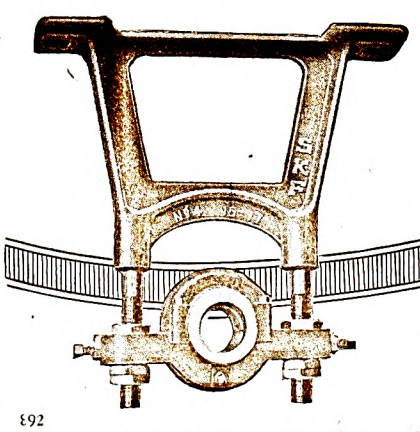
WHEREVER plain-bearing line-shaft equipment is used friction is constantly extracting its heavy toll in power loss, bearing wear and destruction, and forced idleness of both machines and men. These drains on the profits of industry are enormous, the power loss alone amounting to a considerable item.

Skayef self-aligning ball-bearing hangers prevent approximately 60 per cent of the power loss in line shafting and are not subject to heating and wear which enforce shutdowns for bearing adjustments and replacements.

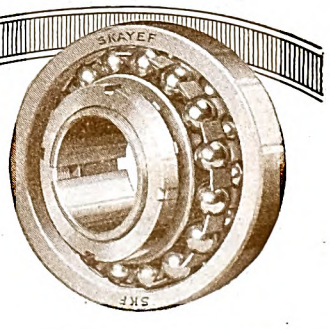
Even shaft deflections and vibration cannot affect the free running qualities of the SKF marked self-aligning ball bearings used in Skayef hangers, for this type of bearing has the exclusive inherent ability of compensating automatically for shaft mis-alignment. As friction is reduced to a minimum and as dust and grit cannot enter the sealed bearing housings, no appreciable wear of the hard steel balls and races occurs. Lubricant cannot escape from the sealed housings onto the floor, belts and goods in process of manufacture, and need be applied only at infrequent intervals.

Let our engineers co-operate in planning a changeover to ball-bearing equipment.

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Self-Aligning
Ball Bearing
HANGERS
(IMPROVED TYPE)



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Where Do We Stand?

(*Continued from page 17*)

indeterminate peace conditions which followed make greatly more difficult the use of the ordinary trade indicators in the years intervening, but one must not forget that "prewar" again means the passage of a decade, and a decade in which science and invention have aided the processes of industry as in no preceding similar period of commercial history.

There is not only the normal increase of an enlarging population and the normal increase which follows a resumption of the constantly advancing standard of human possession which has been the feature of our national growth, but there is besides the acceleration of that standard of human possession by the very enlargement of human earning power which science and directing genius have made unmistakably effective.

Since 1913 then, these influences have come into play:

Our population has increased 14 million, with all that means of enlarged requirements.

Our annual national income has increased from 34 billion to over 50 billion dollars, with all that means of buying and investment power.

Our aggregate savings deposits have increased from 6 billion to 14 billion dollars with all that illustrates of the reward to thrift and self-denial.

Our deposits in national banks increased from six to seventeen billion dollars, with all that indicates of the accumulation of liquid capital for investment and for enterprise.

The basis of individual earnings by which these figures of aggregate wealth increase are created, and the accelerated pace at which the earnings power is secured and enlarged, can be briefly stated, thus:

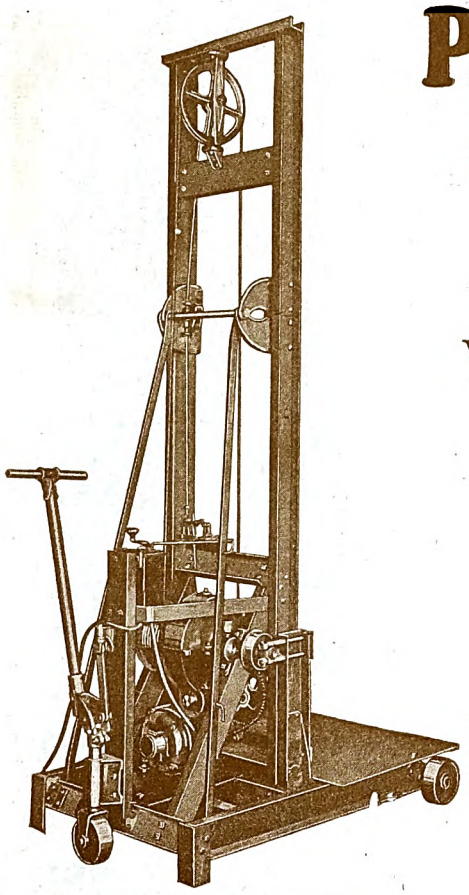
The per capita annual earnings in the United States at the following datum points were:

1850—approximately $100.
1890—approximately $200.
1920—approximately $600.

This shows that, whereas it took forty years to double the average annual earnings in this country, the succeeding thirty years trebled that earning power. These indicators show why in three hundred years of national history the United States has built a total national wealth of 300 billion dollars, with its nearest rival, the British Empire, with two thousand years of productive history, attaining a national wealth of 170 billion dollars.

If from this showing one may accept the great earning power of American initiative, energy and directing ability, then one may also fairly test the political and social system under which this material wealth has been created, by applying a test of its actual service in establishing widespread individual prosperity and content. Has this great aggregate of human possession been fairly and equitably distributed into many hands, or is it concentrated in a wealthy few? The proof of its wide distribution is written beyond question

Make Every Foot of Air Space Pay-You-Rent!



Electric Power Stacker—Type P

Heights: from 6 ft. up; Capacities: 1000 and 2000 pounds; Lifting Speed: 20 and 40 ft. per minute. Automatic safety stop top and bottom—eliminating danger of damage through negligence.

Branches in 22 Principal Cities

The Latest Development in Portable Elevators

The Lewis-Shepard

WORM DRIVE STACKER

(Type P, 2½ h. p. Heavy Duty Electric Stacker) as shown at left.

The Stacker that's Different!

Worm Drive operating in oil bath. Longest and most satisfactory service assured.

NO EXPOSED GEARS

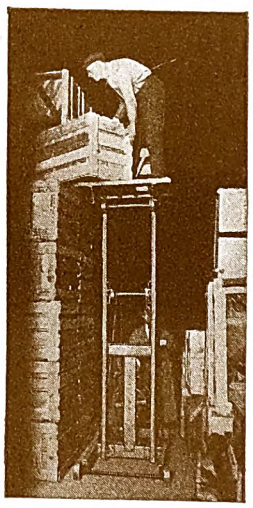
It will pay you to investigate this last word on Portable Elevators. We also make a hand operated Stacker and a combination (hand and ½ h. p. electric) Stacker.

No advance in Prices on Stackers and Jacklifts.

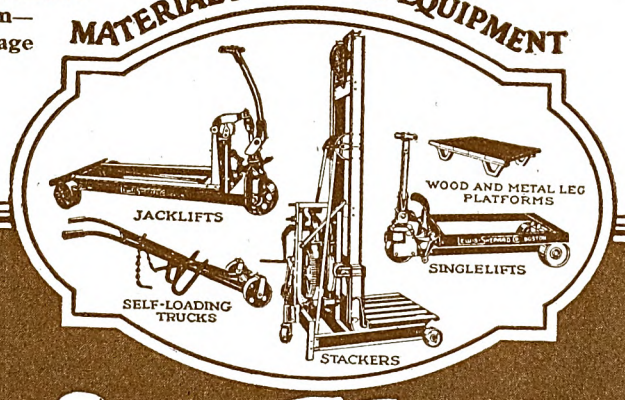
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LEWIS-SHEPARD MATERIAL HANDLING EQUIPMENT



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in the swelling volume of aggregate production of articles of human use, which, because of its very volume currently marketed, shows the possession of buying power in millions and millions of consumers. Such increasing production of articles of human use could not be maintained if wealth and buying power were in the hands of relatively few fortunate possessors. The story is told, for instance, in this simple analysis of the twenty years between census points of 1900 and 1920:

Our population increased 40 per cent.

The volume of our food production increased 38 per cent., showing secure assurance of our home supplies.

The volume of mine production increased 128 per cent., showing a secure basis of service for the fabrication of industry.

The volume of our factory production increased 95 per cent., showing that 1920, with 40 per cent. more of population, there were produced articles of human use of double the quantity produced in 1900.

Moreover, eliminating from this volume of industrial product those articles which are currently consumed, such as food and clothing, there is a remainder of permanent addition to household and other human use which may be reasonably calculated to have expanded the general average of possession of the American home in 1920 to be three times the articles of human use as in 1900. This may be roughly checked by the most casual observation of how recently there has come into general use such things as plumbing, and bathrooms, and telephones and phonographs, and electric fixtures and automobiles.

Automobiles—In 1906 we had one automobile for 1788 of our people. In 1920, one for each eleven. In fourteen years we had progressed so that one in eleven had the use of an automobile, where fourteen years before it was one in 1800.

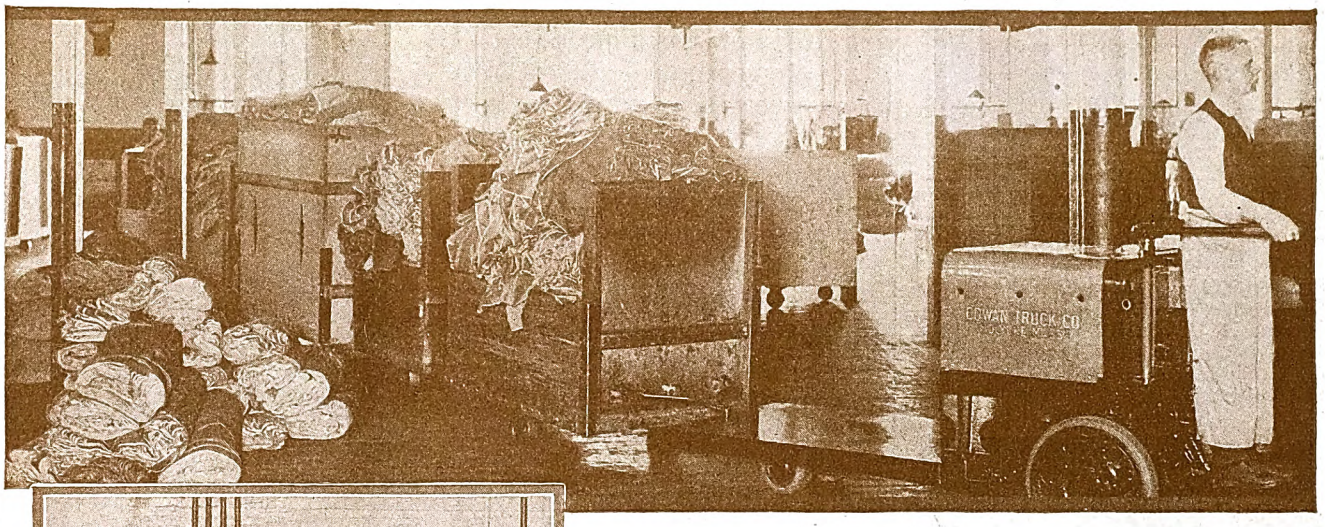
Telephones—In 1900 we had one telephone for each 84 of our people, and in 1920, one for each eight. That is in twenty years we had increased the use of the telephone in daily use ten times.

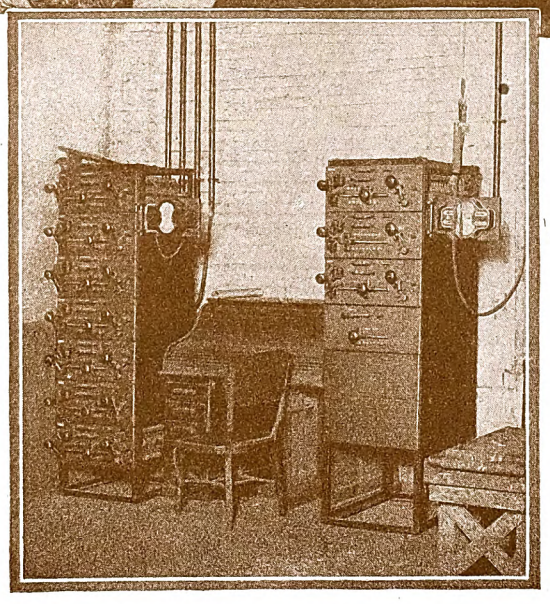
Electricity—In 1907, one to forty-five of our people used electricity, and in 1917, one to fourteen, in city and country.

Phonographs—We produced, in 1909, instruments to the extent of 350,000, and in 1920, two and one-half million instruments. Applying again a mathematical progression it indicates that in ten years we have put in the homes of this country fifteen million such instruments.

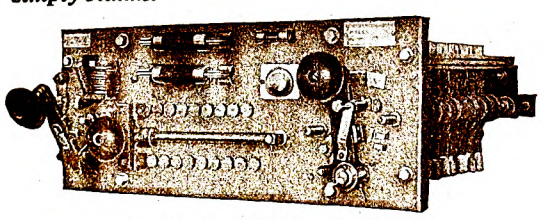
In twenty years we have developed in America four major industries that our fathers scarcely conceived. The automobile industry, the motion picture, the electrical and the chemical industries. Those four major industries, the development of the last twenty years, today afford a livelihood for probably twenty million people. They are maintained by the release of workers from agriculture and other industries, through the substitution of the mechanical production of science itself, so that we rely as never before on the continued service of science and invention translated into human needs through the processes of large-scale industry, distinctly American.

If there has been one out-





In the above illustration, the left-hand panel is built up of seven individual units or rheostats, each taking care of one charging circuit. At the right, three units are mounted at top with a discharge unit below. Space is available for two or three more units at bottom of this panel. The two lower slate fronts shown are simply blanks.



One Complete C-H Charging Rheostat

Two, three or more of these may be arranged on floor type panels and any number of panels located side by side or separately as space and conditions demand. Protection is provided against damage to batteries—a signal lamp is furnished to show when unit is connected up to a battery. Any attendant can be easily instructed in their use. Automatic types also made which are desirable where no attendant is on the job during the charging periods.

Prevent Material Handling Delays

Keep the Batteries Properly Charged

Your investment in battery-driven trucks is best guarded—and delays in material handling and production eliminated by keeping the batteries properly charged.

C-H Battery Charging Equipment is the result of experience in the design and manufacture of such equipment extending back to the first commercial uses of battery-driven vehicles and trucks.

Every provision for the correct charging and protection of batteries is provided. And each of the charging units or sections is complete in itself and alike in size so that additions can be easily made at any time as your fleet of trucks is extended.

Thus present and possible future requirements may be planned and space allowed—but *only the equipment you require to take care of your present fleet need be purchased now.*

Thousands of these units are in use in all parts of the country for the charging of industrial trucks, street vehicles, and battery locomotives.

Booklet 830 contains complete information. Ask the C-H office nearest you to mail a copy.

THE CUTLER-HAMMER MFG. CO.

New York Cincinnati Chicago Detroit
Boston New Haven Cleveland Buffalo
Pittsburgh Philadelphia St. Louis
Northern Electric Co., Ltd., Montreal, Canada

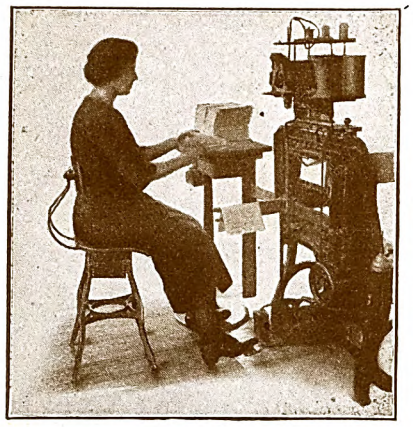
Works: MILWAUKEE and CHICAGO

C-H CUTLER-HAMMER **CHARGING EQUIPMENT**

When writing advertisers please mention Industry Illustrated

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UHL STEEL Postur Chairs



The illustration shows seat tilted forward which brings the back with it. Note the straight line spine and the properly located back support

This bindery operator is scientifically seated upon a Uhl Steel PosturChair, which increases her production, furnishes comfort during the entire day. And, her body is in the position health demands it should be.



The Uhl Steel PosturChair fits the body. The seated skeleton shows correct support. Note how the pelvic bones are relieved by the seat shape.

Fatigue is the thief of production. Incorrect support of the body breeds poor health. No employer would knowingly sanction impairment of health resulting from wrong chairs. And, increased production is being sought by every means. The Uhl Steel PosturChair is the answer

PosturChairs have been designed in conjunction with, and are approved by the American Posture League of New York. Each chair bears label of approvel.

SPECIAL FEATURES: Made of cold rolled steel except seat and back which are wood. 10 heights each with 3" height adustment. Seat tilts forward or backward. Swivel seats when wanted. Durably built, neatly finished.



This is the No. 8150-V. WB, 28" high adjustable to 31". Nine other sizes. Note shape of seat Sit in it and be convinced.

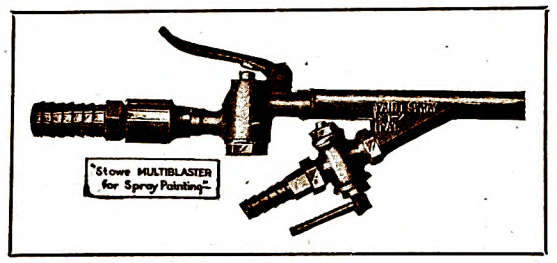
TRY ONE AT OUR RISK

If you are seeking more production and greater health protection for your workers, write us for a sample to try under your own conditions. It's free for two weeks use. Mention height needed. Descriptive pamphlets available.

THE TOLEDO METAL FURNITURE CO.
1608 Hastings St., Toledo, O.
Manufacturers of steel equipment for factories, stores, offices and schools.

standing contribution which America has made to industrial processes, and their reflection into social service, it is the demonstration that production, stimulated and enlarged more and more, thus, by the very economy of cost which follows mass production and by the security of earning and buying power which follows its own enlarged employment, does raise directly the general standard of living; that enlarged production through mechanical aids so far from releasing workers to unemployment, does by its very influence enormously expand employment opportunity and make more secure the common standard of living.

The agricultural industry, for instance, is not commonly deemed to be one highly mechanized. Yet there are these significant indicators of the efficiency of that industry and the underlying service of the American adaptability to mechanical aids. The census of 1920 showed 1,700,000 fewer workers in agriculture than in 1910, but, notwithstanding this decrease in agricultural workers, there was increase in the quantity of each one of the important cereal crops, and this increase was as high as 30 per cent. in the case of wheat. Even under the "prewar" comparison our cereal production increased from 4½ billion in 1913, to 5¼ billion in 1922. It is carefully calculated that the wheat crop of today requires the equivalent of seven million days of manual labor; but if that crop were today produced on the methods before the invention of the reaper, and its succeeding mechanical devices, it would require 130 million working days' labor. The reduction of 130 million days of manual labor to seven million typifies the premium America puts upon the release of human labor to the production of other articles of human use as fast as mechanical devices can accomplish that release. There are countries in the world today whose agricultural methods and agricultural implements are still those of centuries ago. The world which sometimes superficially criticizes our agricultural production per acre, is content to record an average of 1½ tons annual cereal production per



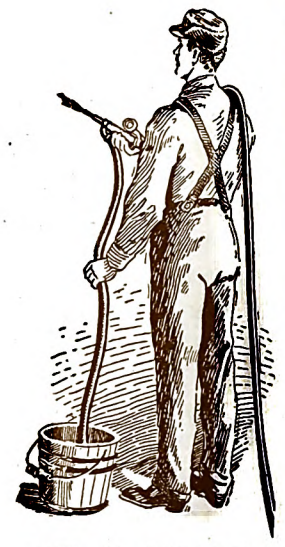
One Man Can Paint 3000 sq. ft. per Hour

—by the use of the Multiblasters. In this time he can give that entire area a thorough coating equal to two or three coats by brush! And aside from the time saved by eliminating the extra coats, the "man behind the gun" operating a Multiblaster can do six times as much painting as a brush worker.

There is Less Paint Wasted

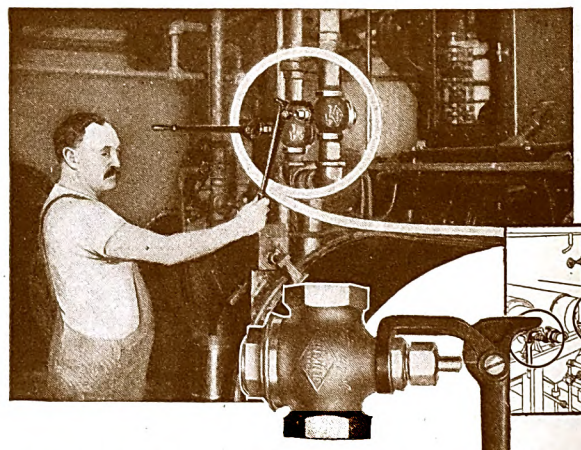
by this method, and the fact that the paint is drawn into the spray by suction keeps the ingredients stirred up and aids in obtaining a uniform coat, also applying all preserving properties of the mixture.

May we send you via Parcels Post a Multiblaster on 10 days' trial? Ready for instant attachment to your air-lines—paint syphoned from any convenient container — **Price $12.00**, F. O. B., BUFFALO. Shipping weight 3 lbs. Requires 40-50 lbs., air pressure.



"The Man Behind the Gun"
(COPYRIGHTED)

Geo. M. Stowe, Jr. Manufacturer
68 Forest Ave., Buffalo, New York
Makers also of Stowe Multiblasters for Sand Blasting
Multiblaster for Mechanical Application of Paint



This RAPID ACTION VALVE saves time

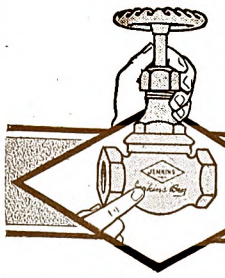
An instantaneous, flow with one quarter pull of lever—stays open automatically.

The Jenkins Rapid Action Valve fulfills a long felt need for a valve that can be opened and closed instantly without water-hammer, and that will automatically stay open without the aid of set screws, locking devices or other appliances.

It saves time and stops water waste in filling wash-wheels. Suitable for use at testing stations. for shower baths, dye works, hat factories, cloth shrinking machines, garages, or wherever a quick acting, dependable valve is required

Send for illustrated folder.

JENKINS BROS.
80 White St., New York, N. Y.

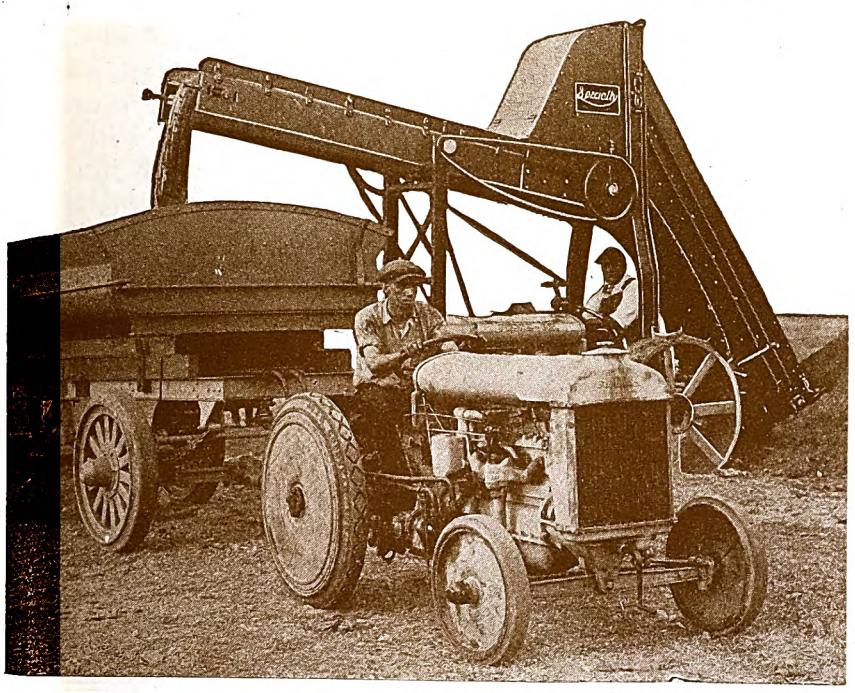


Always marked with the "Diamond"
Jenkins Valves
SINCE 1864

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Specialty Engineering Co.

FORDSON LOADER



50% Less Labor Costs
100% Increased Truck Capacity

IF YOU are worried about next winter's coal supply, why not utilize your storage space now when coal is cheaper?

You can do this without added labor costs with the SPECIALTY Fordson Loader—a **high powered loader** for heavy duty, mounted on, propelled by and operated by a Fordson Tractor.

One firm reports a decrease in labor costs of 50% and an increase of 100% in their truck capacity. Another reports that the loader paid for itself in less than a month.

The Fordson Loader can be used for the handling of any bulk material in addition to coal.

The installation is a comparatively simple operation—any "Fordson" service station will do it in a few hours time. It is readily attached, no holes to be drilled or alterations to be made on the standard Fordson Tractor. The Loader operates at a most efficient speed when operated by the Fordson Tractor—approximately 1000 R. P. M.

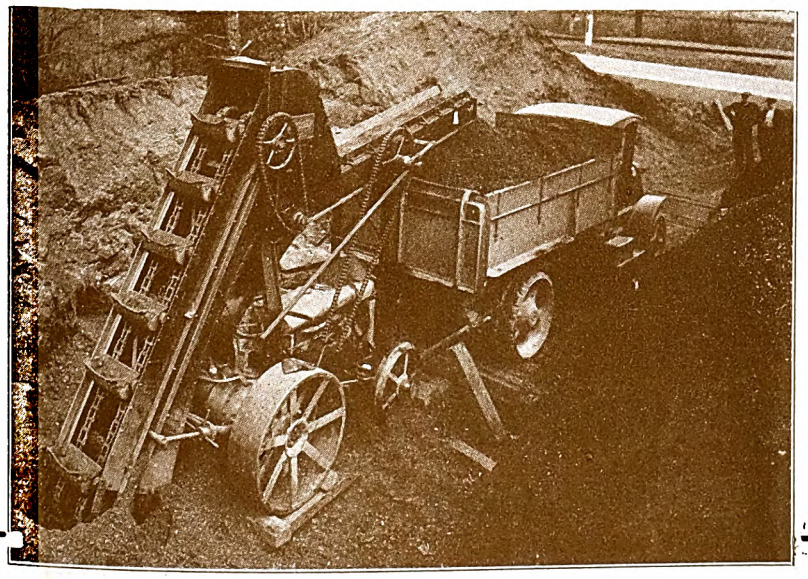
The Fordson Loader is of rugged construction, yet easily moved anywhere.

Let us send complete description and prices or see any Ford Dealer.

for use in

Sand Banks, Coal Storage Yards, Sand and crushed stone, Reclaiming culm piles, Refuse foundry sand, Sand Pits and Mines, Unloading materials from cars, Excavated materials and other bulk materials.

Will do the work better than some Portable Loaders costing twice the price.



SPECIALTY ENGINEERING CO.

Allegheny and Trenton Aves.

PHILADELPHIA, PA.

worker, while America produces, under its typical American philosophy, 12 tons per worker.

If the corn crop of today were to be raised on the methods of 1856—before those special kinds of machinery especially adapted to replacing manual labor in the raising and garnering of corn were used—it would require, by accurate estimate (or so accurate that it shows the trend and tendency), at least one hundred and fifty million working days. Whereas, today, with these mechanical devices, the raising of a corn crop of the present size is estimated to consume forty-three million days, a vast economy in releasing manual labor to other industries producing other articles in human service. In these unique national ideals and national methods rests the secret of the successful competition of the American farm, with its American standards of living, producing an export surplus against competition, in the ultimate market, of cheap labor competitors. In these same national ideals and national methods rests the explanation also of the successful competition of our industrial production of highly paid labor, against the product of cheaper labor and of lower living standards.

In the light of a proper appraisal of these tendencies there is a new interest in trade records just recorded throughout a number of the basic industries.

For instance in March these records have been made:

Cotton consumption, largest ever recorded.

Pig iron production, largest ever recorded.

Steel ingot production, largest ever recorded.

Crude oil production, largest ever recorded.

Zinc production, largest since 1917.

Automobile and truck production (346,000), largest ever recorded.

Railroad car loadings, highest ever recorded for this season of the year.

Residential construction, largest ever recorded.

Sales of Life Insurance, exceeded only once.

Unfilled orders of locomotives, largest ever recorded.

Hang up your soap with a soap-holder



and you'll hang up a new record for low soap consumption.

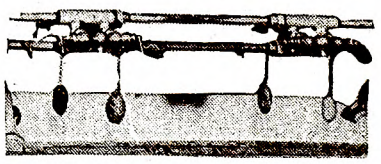
If we would Save you 50%

on the cost of the soap used in your employees' wash rooms and would prove it to you, and at no expense to you whatsoever, it would interest you, wouldn't it?

We can, and will prove it by sending you fixtures to equip your wash room, together with a sufficient amount of soap to give it a thorough try out, and remember it costs you nothing; neither does it place you under any obligation to us whatever. A genuine

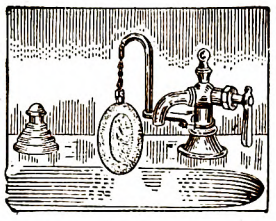
Free TRIAL OFFER

With the soap-holder—soap cannot be carried away, thrown on floor, or left in water to become soft, mushy and unfit for use—it cannot break up when worn and clog drain or make the washstand untidy.



One of many types

These soap-holders are made in many different types and designs. They are made of brass, heavily nickel-plated, or of German silver and extra strong to resist tough usage.



Ingenious locks securely attach the soap to fixtures by means of an anchor imbedded in the bar of soap.
Where these fixtures are installed—every ounce of soap is used.

Write today for full details.

ANCHOR CORE ECONOMY SOAP CO.

136 West Lake Street, Chicago, Ill.

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Volume of retail sales, 10-cent stores, largest ever recorded at this season of year.

Volume of mail order sales, largest ever recorded at this season of year.

The result of this expanded business activity is that the volume of aggregate production has now passed the peak of 1920. The measure of reassurance against the collapse which may follow hectic and feverish activity rests in the fact that the index of wholesale prices is 35 per cent. below the 1920 peak of prices.

That this material progress was not destructive of the educational ideals of our people is indicated by applying another test:

We had enrolled in institutions of advanced learning in this country in 1909, 226,000 students. In 1920 we had 416,000. That is, in eleven years the students in our advanced institutions have almost doubled.

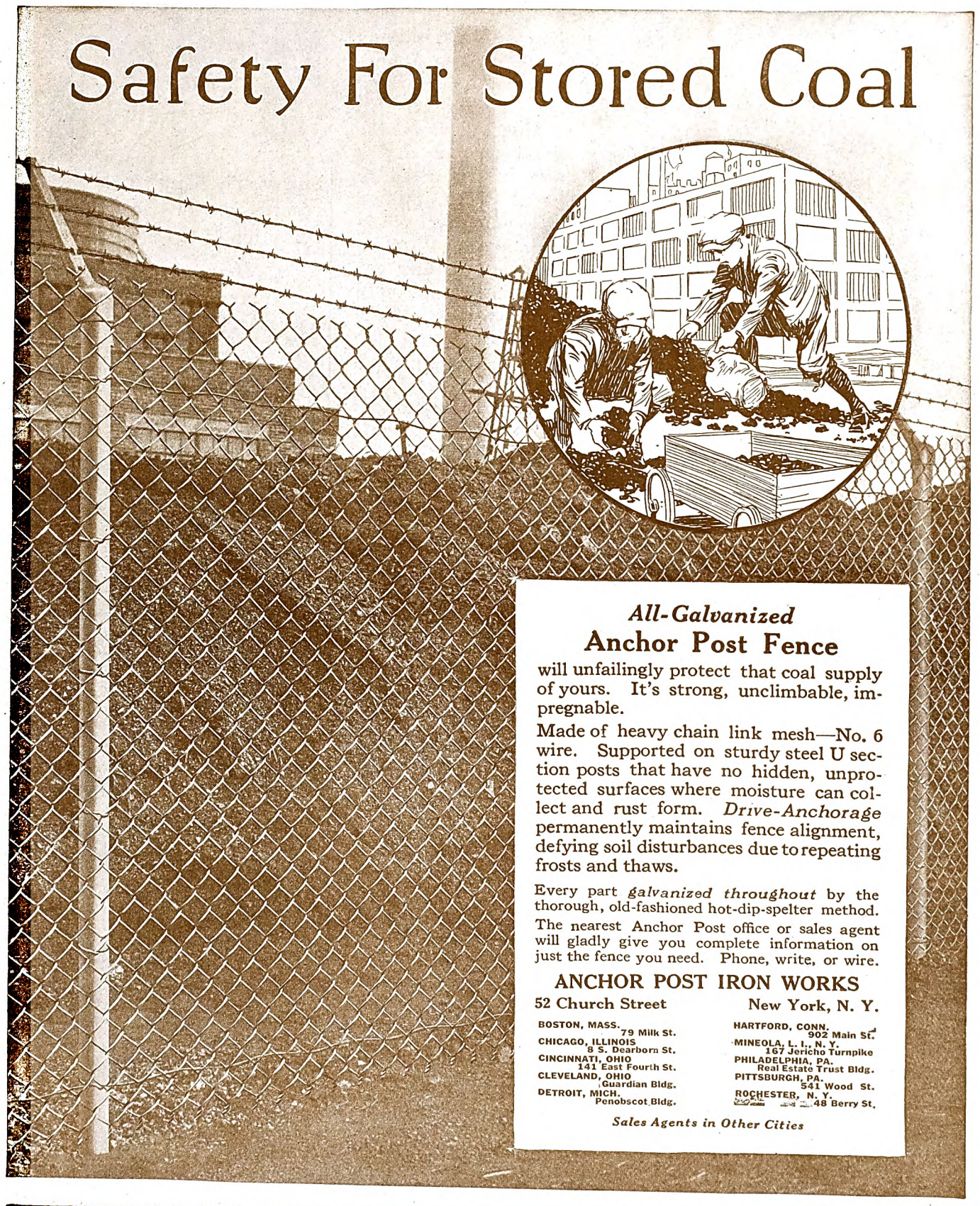
The same story extends through the elementary grades. In elementary education the expanding figures of attendance and the lengthening of average duration of school training are indicative of the increasing training in intellectual power, which must inevitably translate itself into more human capacity to understand and enjoy the finer things of life and to enlarge the human capacity to produce articles of common use which we indicate as an advanced standard of living.

The training which this gives the mentality of our people can not help but add to the general level of earning power throughout our whole country.

The significance of this story of industrial recovery and business activity rests in its accomplishment against a relative lethargy in recovery throughout the Old World. Even though the same tendencies to enlarged earning and saving power are present in Europe, they are manifestly of lesser extent.

There is, then, the very natural desire to know whether this leadership in trade recovery and the re-establishment of opportunity and employment on which rests human welfare, is vested in America primarily because of great natural resources and fortunate geographical position, or whether these results are due to causes that stimulate individual and national accomplishment.

In February an American delegation of some fifty members of the Chamber of Commerce sailed for a preliminary study of conditions in various countries of Europe and for a conference at Rome under the auspices of the International Chamber of Commerce for consideration of steps to aid European recovery from its after-war depression. Because there was the inevitable comparison of American ideals and American methods with those observed abroad, and because these crystallized at Rome in the expression of certain principles on which, alone, national and individual prosperity could be built, I venture to sketch here the background of observation and conclusions on which the American delegation based its recommendations at Rome.



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Egypt—A narrow strip of fertile soil irrigated from a great river, 4,000 years of occupation, recording only a total population of fifteen million people. The explanation of this restricted population growth rests on living standards and practices so defective that, in Cairo, the death rate exists of 75 out of each 100 children up to one year old. Ninety-eight per cent, illiterate, yet demanding universal suffrage and self-government, and pointing to the success of the American republic, with its ten generations of universal education as the justification for its own demands. Wealth in the aggregate, but wealth concentrated in the hands of a relatively few land owners and princes. Its great resource its cotton crop, but whether cotton is 10 cents or 30, the standard of average remains unaffected, at the very minimum. Dirt floors, no rugs, no furniture, even a general lack of table utensils. Its agricultural implements and practices largely those of twenty centuries ago. The plow for instance, having retrograded from the two-handled plow pictured on the chambers of the old temples to the single-handled plow today; otherwise the same. Nevertheless there is the beginning of a more general use of telephones, the telegraph, automobiles and other indications of the beginning of a national stirring with an aspiration for the earning power which allows common possession and creates consuming markets. A great port is developing at Alexandria with modern equipment.

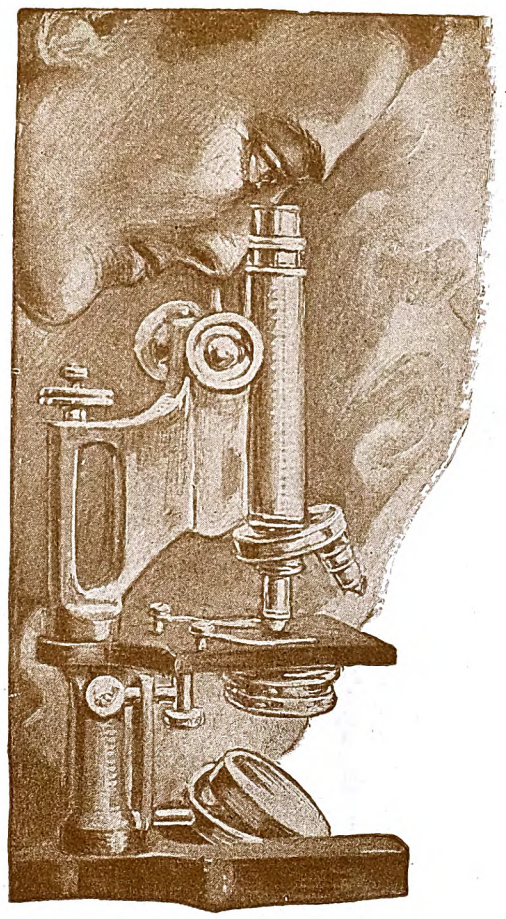
Palestine—Fertile fields, good roads, many autos, new buildings in town and country, an occasional tractor in the field, every evidence of national progress. A lack of safe seaports and the handicap of lighterage expense from vessels in exposed open seaways.

Turkey—A cleaner and more sanitary Constantinople. Evidence of enlarging use of tramcars, telephones and telegraph, and automobiles, which should be considered carefully in view of the fact that fifteen years ago electricity in any form was nationally prohibited. The usual difference of views as to the sincerity of intention and the administrative ability of the new Turk party now in power. Here too, the evidence of large populations beginning to reach after the possession of those things which enlarge human comfort and happiness, and the assurance that earning power which follows these aspirations will create steadily enlarging consuming markets throughout this Near East. Constantinople located to be naturally the trade capital of vast distribution. A stable government which secures life and property and stimulates productive industry, is the prime prequisite for a great national growth.

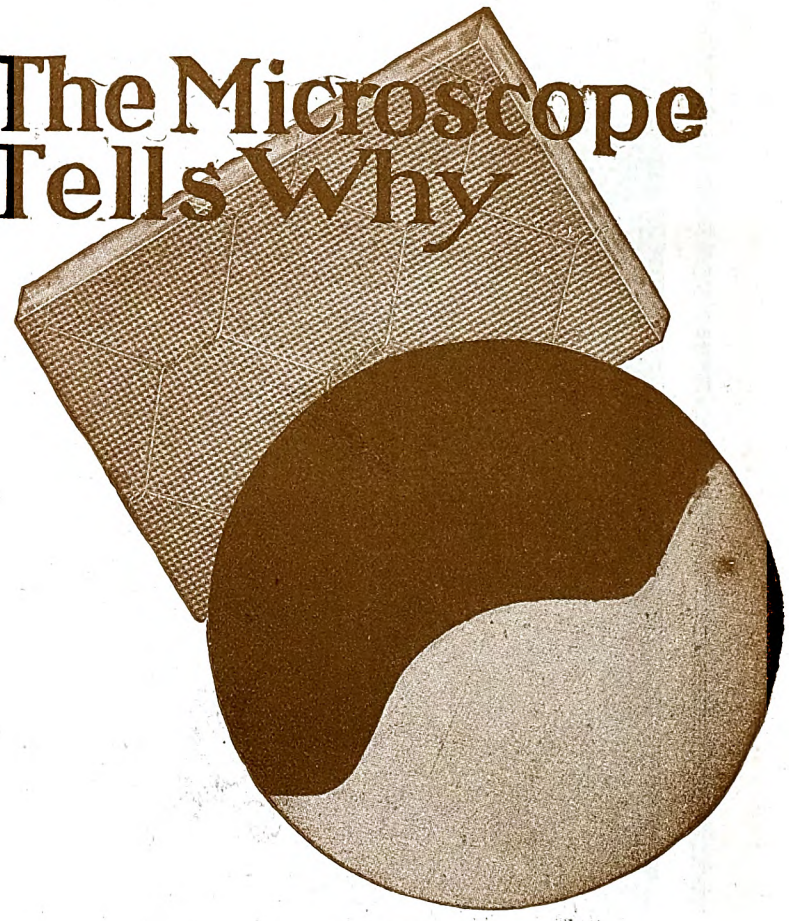
Greece—Only twenty per cent, arable land. A discouraging national finance position. A revolutionary government in control. A great problem of re-absorbing a million Greek refugees from Turkey. Still possessed of the resources of a traditional history which attracts tourists and travelers. Still possessed of the capital of an industrious people and the record of having surmounted in the past many similar crises in their national development.

Algiers—Manifestly prospering, under French direction.

(*Continued on page 71*)

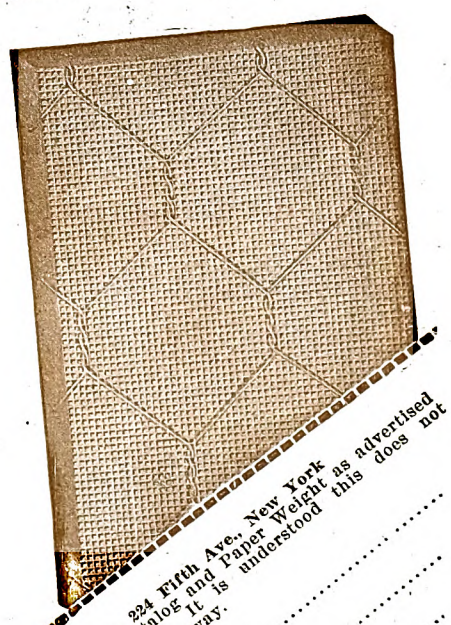


The Microscope Tells Why



FACTROLITE

Diffuses Daylight



Each little pyramid has **plane** sides but a rounded apex, and a rounded fillet between rows.

FACTROLITE is scientifically designed to prevent direct reflection of daylight, even when the light strikes at a narrow angle of incidence to the panes.

At the same time the maximum degree of **diffusion** is attained. The United States Government used FACTROLITE for a big building which required over 100,000 sq.ft. of this improved daylighting glass.

At a time when conservation of resources is a paramount need, why not consider the conservation of daylight?

A sample of FACTROLITE sent on request to any engineer. Simply fill out and mail the attached coupon

The Mississippi Wire Glass Co.

224 Fifth Avenue, New York

CHICAGO ST. LOUIS

Mississippi Wire Glass Co., 224 Fifth Ave., New York
Gentlemen: Send me a Catalog and Paper Weight as advertised in Industry Illustrated. It is understood this does not obligate me in any way.

Name.....

Address.....

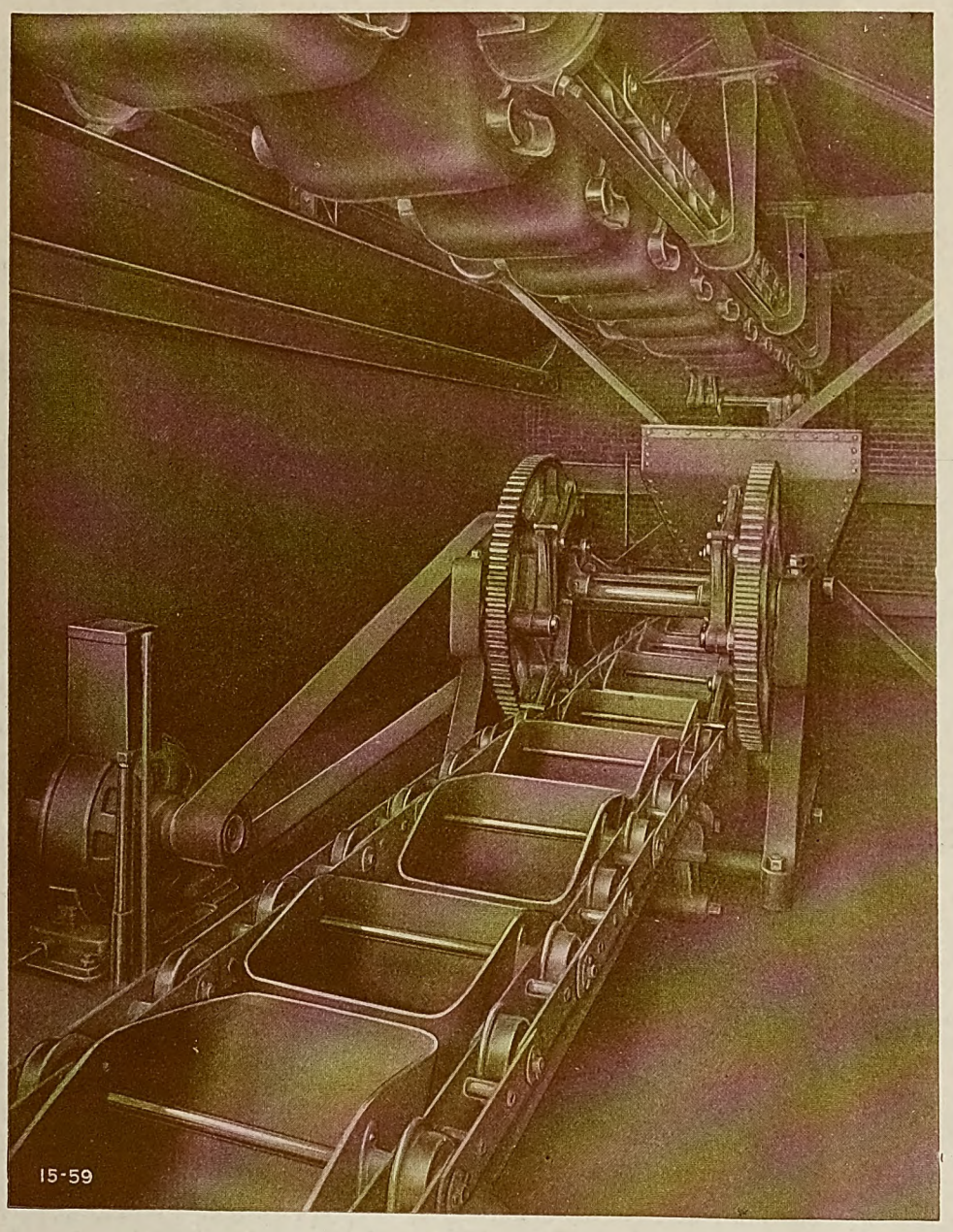
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Will You Read This?

IN an article on "Materials Handling" by Matthew W. Potts, in the May issue of this publication, Mr. Potts said:—

"It is strange that plant executives still have to be told of the many advantages that can be obtained by using mechanical equipment."



Catalogue 20-2-S contains full details with numerous pictures.

He describes and depicts handling equipment in use 128 years ago, among which is a bucket conveyor operated by hand, which he says, was "crude but effective."

If the "crude" apparatus of 1795 was capable of saving labor,—when labor was plentiful;—and saving money,—when money was not so stringent, how much more can be saved in these essentials by using the modern, highly developed Hunt equipment of 1923, when both labor and money are at premium.

This is the question with which every executive should busy himself without loss of time; and Hunt engineers, with the accumulated knowledge gleaned from over half a century experience in materials handling, can be of valuable assistance in helping plan labor, time, and money saving apparatus to fit every requirement of bulk, cased, or packaged materials handling.

Take for example the Hunt Pivoted bucket Conveyor shown here; installed 8 years ago at the Biograph Company's plant, New York City and still giving satisfactory service.

The picture shows clearly the details. To the left is the motor driving the gears to which are attached the *pawls;* which in turn engage the studs between the powerful steel links, *propelling* the buckets along slowly; thus relieving the wheels and bearings of the excessive wear due to driving by sprockets.

Driving by means of *pawls* is an exclusive feature found *only on a Hunt Conveyor*. This exclusive feature has made the reputation of the Hunt known throughout the world; because through this method of driving, the conveyor is given a longer lease of life as the wear is considerably less than with any other type; the operation is more positive and continuous. These advantages coupled with the saving in repairs and labor, are logical inducements for specifying Hunt Conveyors for super-service.

C. W. HUNT CO., Inc.

West New Brighton, New York City

New York Office—Whitehall Building

Phillips, Lang & Co., Inc.,
431 South Dearborn Street, Chicago, Ill.

Ernest F. Learned,
141 Milk Street, Boston, Mass.

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THE TOWMOTOR

VS

THE LABOR

SHORTAGE

THE CHANDLER MOTOR CAR COMPANY

GENERAL OFFICES AND FACTORY,
CLEVELAND, OHIO, U.S.A.

May 1, 1923.

The Towmotor Co.
Cleveland, Ohio.

Gentlemen:

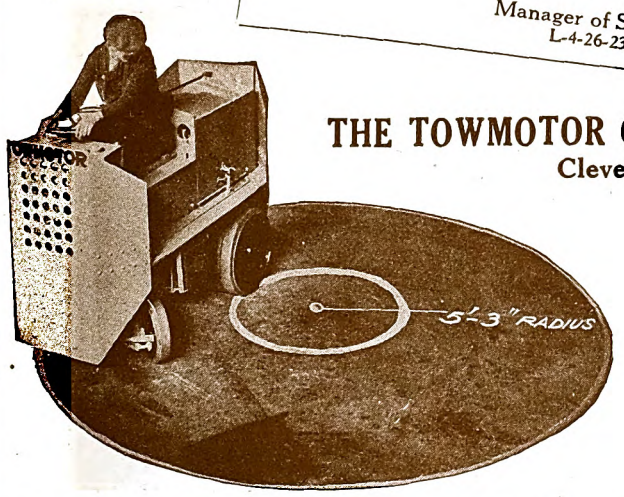
In reply to your letter of April 26th pertaining to our experience with the Towmotor.

We are under the impression that it is the most essential feature in any manufacturing plant. We have no hesitation in saying that our Towmotor has paid for itself many times over, and can accomplish in one day the work of fifty men. Its durability and upkeep under rough usage are more than surprising.

Very truly yours,
THE CHANDLER MOTOR CAR COMPANY

Signed: J. W. Whitehouse

Manager of Service.
L-4-26-23



THE TOWMOTOR COMPANY
Cleveland, Ohio

The Lowest Price Possible for this ROBINS 20 ft. Portable



PRICE
$433.00
F. O. B. Passaic, N. J.

This price does not include power unit.
With 2 HP. A.C. Motor—$94.00 additional.
With 5 HP., "New-Way" gasoline engine—$175.00 additional.

Quantity production enables you to obtain this remarkable Portable conveyor at the low price of $433.00—with features superior to some of the higher priced conveyors.

16" Troughed Belt—large carrying capacity—self-cleaning and arched frame—fully protecting the return belt from dirt accumulation.

Rugged construction—well balanced. Capacity of one ton per minute.

Place your order now to insure early delivery.

Write for Bulletin No. 570

Robins Conveying Belt Co.

New York Chicago Pittsburgh Boston

(*Continued from page 69*)

A modern port under construction for its expanding commerce based on its own increasing production.

Italy—New life and energy. A general confidence in its future, possessing the great resource of an industrious people, few natural resources but manifest progress in realizing on its hydro-electric possibilities. Its confidence in the future typified by such ports as Palermo constructing a modern harbor and modern warehouses by American contractors using American capital. An ancient city, but possessing miles of asphalt streets and new residence districts that compare favorably with Minneapolis or Los Angeles; planning to attract and care for the distributive trade of the Mediterranean. Throughout all Italy, in all classes, a great rallying to the Nationalist movement, symbolized by the Fascisti. A great national fervor evidenced by Latin oratory and marching songs, but also sustained by a great general appreciation that national progress is made by work and devotion. A strong man in control, one forced by the logic of demonstrated failure to change socialist convictions for maturer appreciation of individualism and private enterprise, moving with determination to put State services into more efficient private direction, determined to lift the burden of unncessary personnel and depressing State expenditures, and with every evidence of clear progress toward a sound national budget and the rebuilding of national and individual prosperity.

Austria—A demonstration of the ineffectiveness of parliamentary government under bloc groupings, brought to bankruptcy by the easy immorality of the socialist conception of State care for the individual, unable to set its house in order except by appeal to stronger and abler directions, tying its own hands by constitutional abdication of parliamentary interference for two years as a condition for administration by the League of Nations, putting into effect by stipulation of this League administration sounder national policies of taxation, reducing its State expenditures by elim-

(*Continued on page 73*)

ELWELL-PARKER



HAND OR ELECTRIC TRUCKING?

Time has nearly passed for choosing.

ELWELL-PARKER
Electric Industrial Trucks and Tractors
are available now
but common labor is not

ELWELL-PARKERS
lift, carry, and place the loads where wanted.
They will deliver eight times the load at three times the speed of a hand trucker.
They are always ready, work early and late. Many operate 23 hours per day.

60% of all handling can be done by these units. May be driven practically any place a hand truck can be pushed.

Thousands in operation in over 200 branches of industry in 23 different countries. Tried and proven equal to every inside haulage requirement. Many have been in continuous service for over 10 years.

ELWELL-PARKER
trucks are guaranteed to save from the very start.

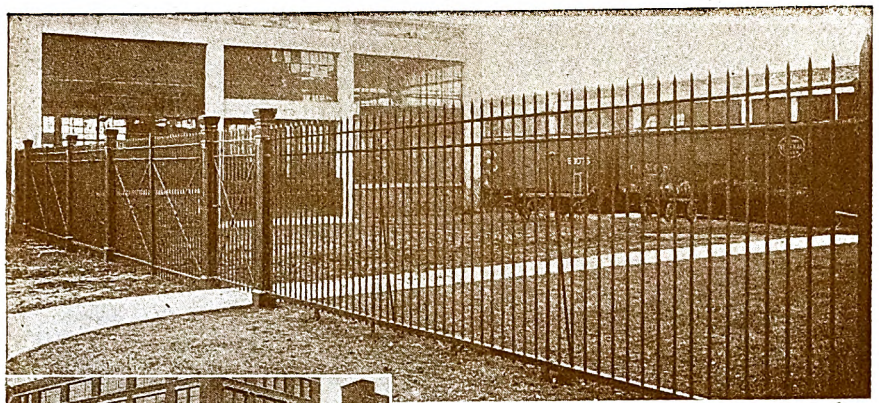
SELF-LOADING TRUCKS
DUMPING TRUCKS
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Our unobligating survey is yours on request, or ask for Bulletin 51.

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ELECTRIC COMPANY,
CLEVELAND



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Fine Fencing Like This

Is a permanent, positive protection against industrial hazards. And the cost of this protection is extremely low—much less than you think. Besides good fencing, all iron or chain link, adds greatly to the appearance of your plant and increases property values.

Get a price on the fencing or gates you've been wanting. Write today for our catalog. See a blue print of the fence as it would appear installed—and know the cost. It will pay you.

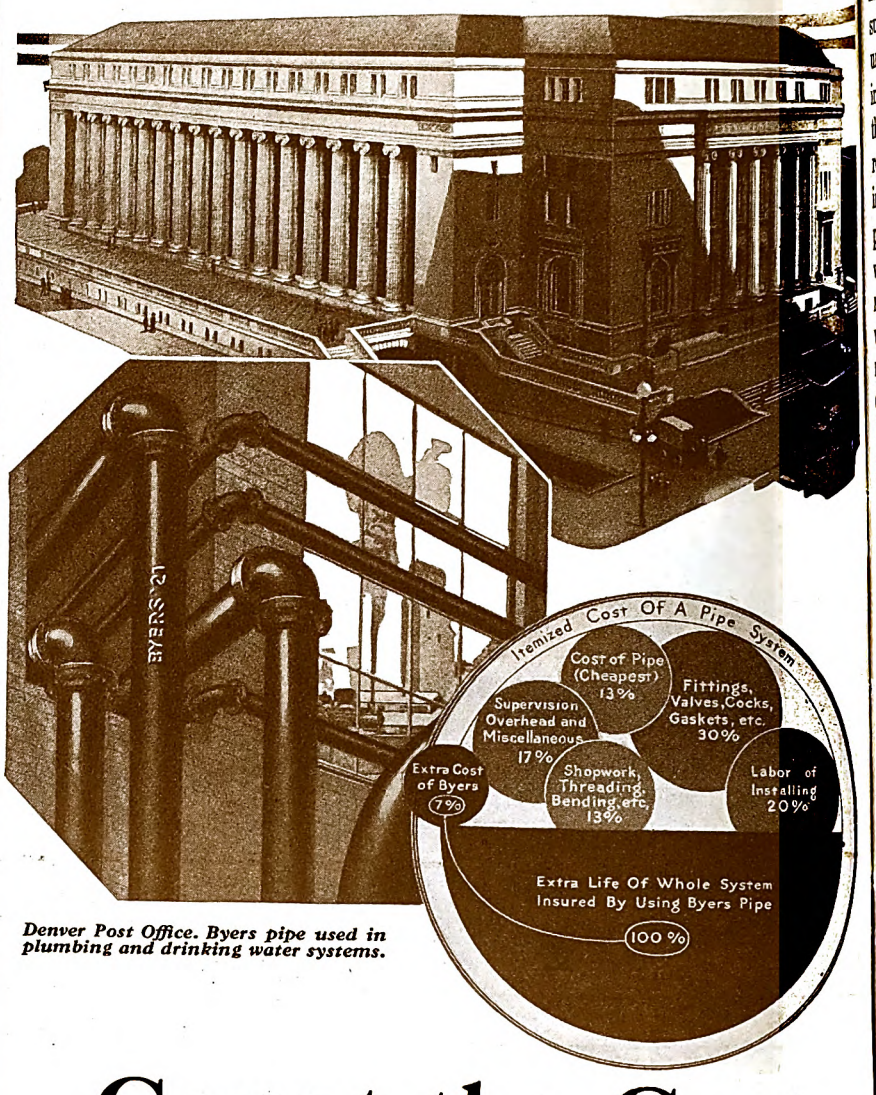


ENTERPRISE IRON WORKS
1112 E. 24th St. Indianapolis, Ind.



BYERS PIPE

GENUINE WROUGHT IRON



Denver Post Office. Byers pipe used in plumbing and drinking water systems.

Count the Cost

but count it correctly

THE choice of pipe for any plumbing, heating, power and other pipe system, is dependent on its price as well as its rust-resistance. The aim is to use pipe which will last as long as the useful life of the building or structure of which it is a part.

If the structure is expected to serve its purpose for 50 years, and the pipe rusts out in 25 years, then the pipe is dear at any price.

Because Byers pipe, installed upwards of 30 years ago, is invariably found in excellent condition in buildings everywhere, it may, in the vast majority of cases, be expected to last as long as the structure of which it forms so essential a part.

You might use pipe which costs much more than Byers, and gain nothing in *useful* life. Or you might get cheaper pipe, which would lower the initial cost of the pipe system by only 5 or 10%, but which would rust out long before the building has outlived its usefulness.

In both cases you lose.

Prevent this loss by specifying Byers pipe—the most economical long-life pipe for plumbing, heating, power and industrial pipe systems.

Based on installation cost, the extra cost of Byers pipe is trifling. See diagram. Ask for Bulletin No. 38, "The Installation Cost of Pipe"

A. M. BYERS COMPANY, PITTSBURGH, PA.

Established 1864

New York Philadelphia Boston Chicago Cleveland Houston

Distributors in all Jobbing Centers

Skinner Junior High School, Denver. Architect: W. Harry Edwards, Denver. Byers pipe used in plumbing, drainage, fire lines and drinking water systems.



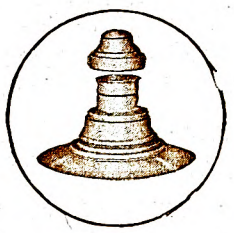
Look for the Name and Year rolled in every length

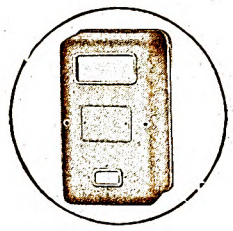
G.P.&F. Service
Knowing How Since 81

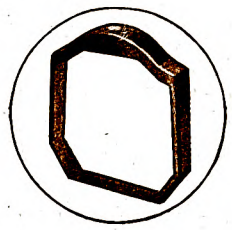
Let us figure on

STAMPINGS—

Sheet Metal Parts







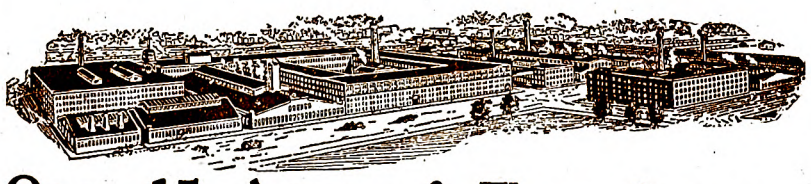
When you consider G. P. & F. Service as a source of supply for your Stampings and Pressed Metal Parts the equipment that turns out 100,000 parts daily and a 15 acre plant are put at your disposal

We also develop pressed parts for replacing castings, forgings and wooden parts.

Over 41 years experience in the work.

Send blue prints or samples—we'll send estimates promptly.

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Over 15 Acres of Floor Space—

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(Continued from page 71)

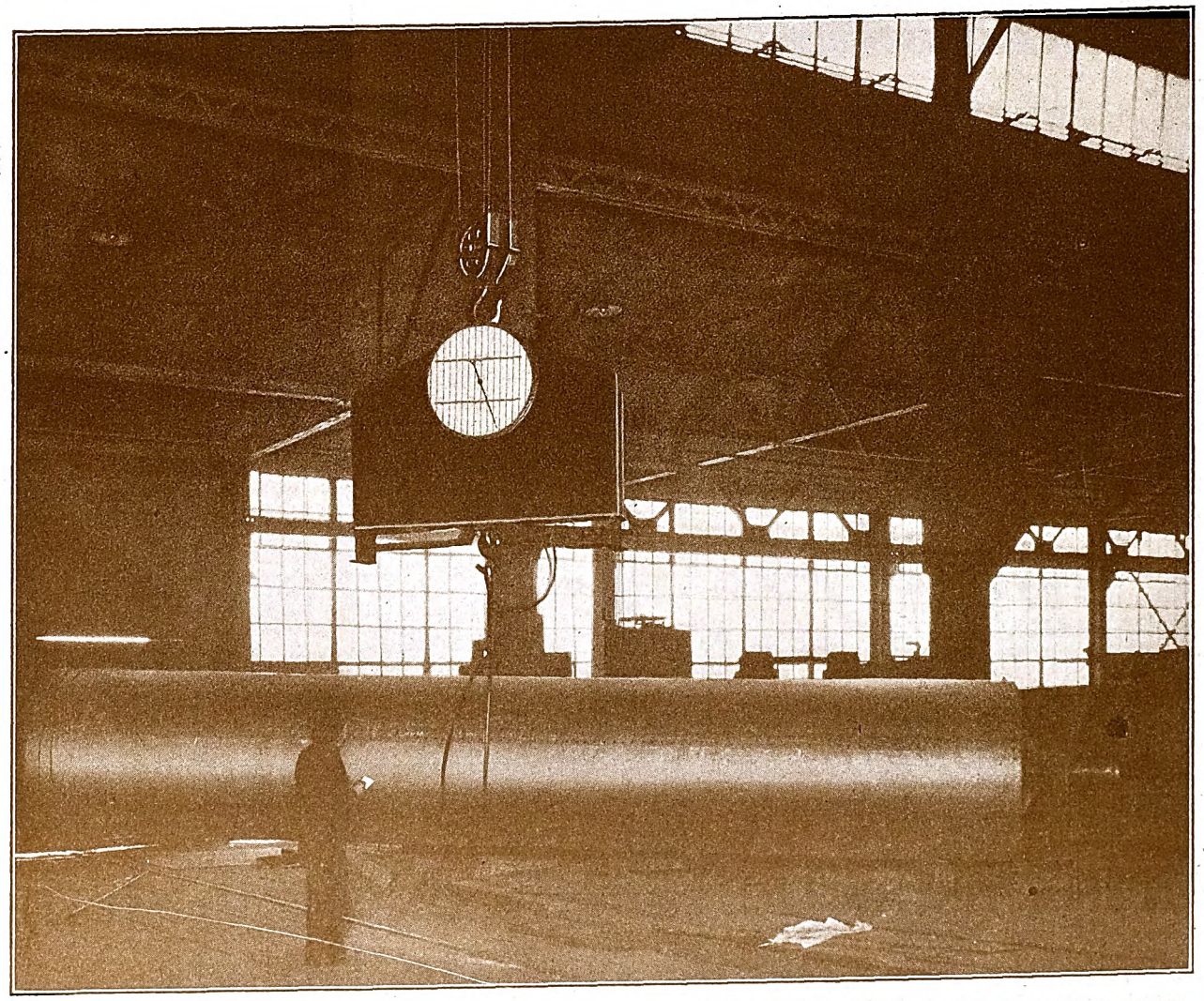
inating unnecessary personnel, discontinuing further issues of paper monies, resulting in a natural stabilization of the Austrian crown and, again, resulting in the disclosure of an unsuspected buying and saving power when people are thus relieved of the fear of currency depreciation loss, savings accounts increasing 600 per cent. in four months. No vacant stores, houses or apartments in Vienna. A gradual revival of national economic life, reducing the charity-fed children in Vienna from 300,000 to 10,000, largely remaining orphans. A new hope and courage, a stimulated effort to complete trade agreements with surrounding countries, by which the age-old experience of Vienna in the direction and financing of industry throughout Central Europe could be made again effective across newly-constructed frontiers which for three years have blocked the former channels of trade and commerce. A considerable progress in this direction. An able administrator sent to Vienna by the League after seventeen years of administration as Mayor of Rotterdam, convinced himself by study and experience on the ground that Austria will be successfully recreated.

Czechoslovakia — Ninety-eight per cent. literate, a great nationalistic spirit, a sound national budget, a stabilized currency, with the passing handicap of relatively large unemployment, against the surrounding depreciated money countries which are still capitalizing the tradition of value which still adheres to the name of "Mark" and "Crown," waiting patiently the day when producers and workers can no longer be deceived by the nominal designation of a money token and production costs must be equalized, knowing that then their sound conditions for government and industry will give them their rightfull leadership.

Poland — Showing distinct progress in its industry; railroad service good; surprising its friends by an adaptability to self-government which disproves the tradition of Polish inability to govern by conference and concession. Confident also of a day when the revival of national life in Russia will facilitate its own.

Germany—Unusual difficulty in reaching conclusions, some building expansion, considerable restoration and fresh paint on buildings and homes, shortened employment in industries feeling the restricted supplies from the Ruhr, with wages made up to full week earnings by government doles, continued record emission of paper marks inevitably producing distrust of the artificial mark stabilization undertaken by the government, 18 per cent. official bank discount rate, passive resistance policy and unsettled reparations with possible developments, make all opinions of trade conditions and outlook of doubtful value.

France—Industrious as ever, fully cultivated fields, many tractors, good roads, restored railways and waterways, busy towns, 350,000 imported workmen to make up the equipping of its industries. Every evidence of individual earning power with a margin of saving which, with the confidence of its people in its government, will probably provide a continuing source of investment



At the Lasker Iron Works, Chicago—KRON CRANE SCALE
Weighs without a *Second Lost* —

KRON
Dormant Scales
Portable Scales
Suspension Scales
Crane Scales
Larry Car Scales
Monorail Scales
Counting Scales
Industrial Car Scales

BOILERS and other heavy materials up to 20,000 lbs. are weighed on this KRON CRANE SCALE without any time lost—without any additional labor cost.

The KRON is always on the job—never on the payroll.

Send for the KRON Booklet, "Load and Look." It gives many labor saving weighing suggestions. Fully illustrated. Why not write for it now.

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power especially confined to France as long as the franc value is prejudiced against foreign investments.

Great Britain—Its house in order, able to relax taxation which was voluntarily assumed in re-attaining the financial leadership of the world. Its pound sterling practically back to gold parity, although carrying the financial burdens of some of its allies. Some unemployment but steadily decreasing. Some signs of improvement in its carrying trade which is the indicator for all its conversion industry. Its utterances not quite so pessimistic. Its efforts, as always, unrelaxed and persistently directed along sane effective channels.

Russia—With the restoration of some opportunity for private enterprise and with the return of a measure of inducement for private attainment, beginning to rise a little from the level of almost utter barbarism to which it had sunk under communistic mal-administration. The low water-mark typified by the official statement at Genoa in 1922 of actual production, in a great agricultural country, of plows at 13 per cent. of pre-war; agricultural implements at six per cent, of pre-war; and cast iron at two per cent. of pre-war production. Apparent evidence that a country which used to contribute 250 million bushels annually to feed the world, has succeeded in producing food enough to relieve famine this year and to contribute ten to fifteen million bushels of export, surplus. Able to dress its window by an occasional sleeper, and even diner, on its railroads. Exciting the wonder of the world that 150 million people, possessed of vast stretches of fertile country, great forests, natural resources of coal and metals, with two thousand years of social progress elsewhere for its guidance, can finally by the simple expedient of recognizing the primary individual human impulse, make the first steps in establishing living standards above the barest requirements of food and clothing. Hopeful, nevertheless, that the record of utter destruction under communistic practices and the record of even the most trivial recovery of opportunity for the individual, will point the way when this country will be re-entered, in the processes of domestic and foreign commerce.

At the general session of the International Chamber of Commerce in Rome, March 24, 1923, the following resolution of production was moved and adopted:

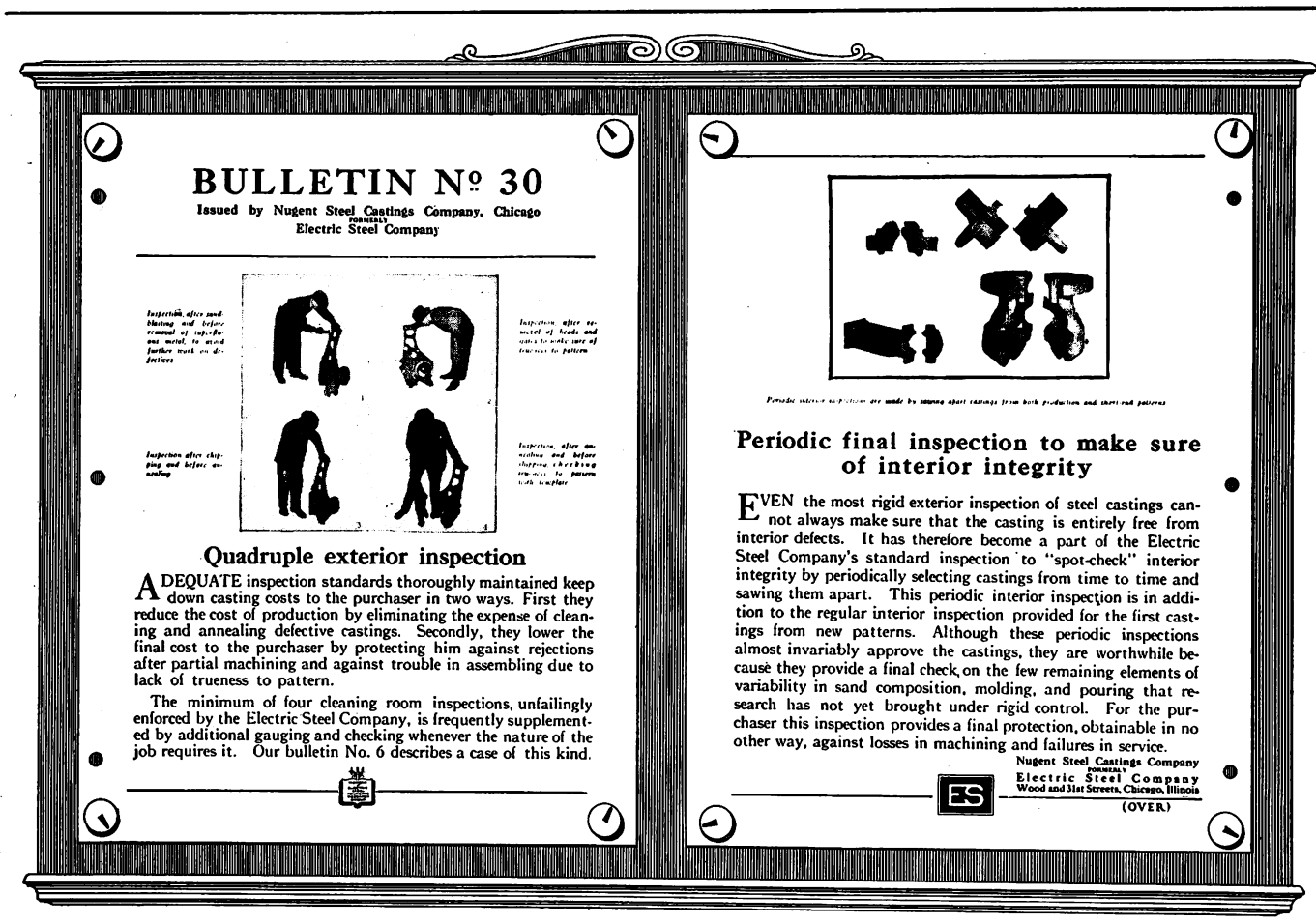
Whereas, it is increasingly clear that the national wealth and community and individual prosperity depend to a large extent for maintenance and increase on expanding individual production in all lines of industry and that the greater the production, the greater the benefit to all concerned, and

Whereas, international credits to facilitate production and exchange of goods can rest only a sound basis of material values, and

Whereas, real costs of production in various places and in various lines remain abnormally high and efficiency of production and individual output frequently remain lower than before the World War, and

Whereas, the present depressing burden of after-war

(*Continued on page 76*)



These inspection methods diminish the cost of cast steel parts

Lowering costs in two ways

THE thorough inspection methods that modern steel founding has developed are of great importance to the manufacturer using cast steel parts in his assemblies. As described in the bulletin reproduced above, these methods lower costs in two ways.

By eliminating the expense of cleaning and annealing defective castings that ordinary inspection would not reject until they reached the shipping floor, the cost of production is materially reduced. By protecting the purchaser against rejections after partial machining, the inspections reduce the cost of using cast parts. In addition, the assurance of absolute trueness to pattern that these methods provide, protects against assembly and machining troubles.

Pioneering new developments

The thorough inspections outlined in our Bulletin No. 30 are only one of many developments in modern steel founding that we have helped to pioneer. New molding methods have been devised to accommodate the hot metal of the electric furnace—metal which permits us to produce castings of varying sections or intricate design difficult to pour with the colder "melt" of other types of furnaces. New devices for testing and controlling sand mixtures have been created for similar reasons, and new ladle linings have been compounded.

Send for these bulletins

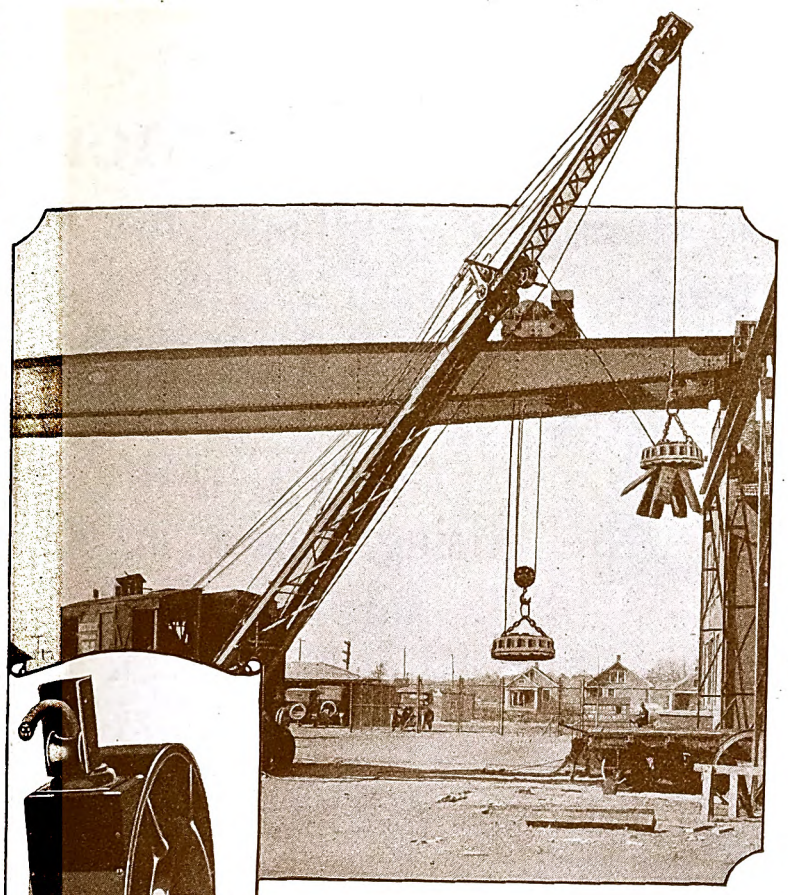
Send for our D series of Bulletins describing the work of the Nugent Steel Castings Company and the Electric Steel Founders' Research Group.

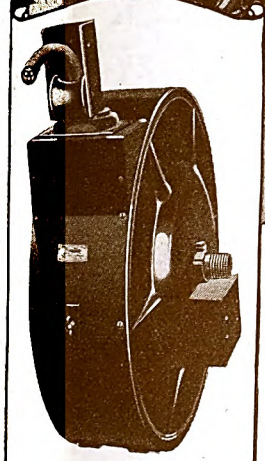
Nugent Steel Castings Company, Chicago, *formerly* Electric Steel Company

NUGENT STEEL

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Reelite Economy for Lifting Magnets

The heavy duty Reelite is particularly adapted for use with lifting magnets on traveling or boom type cranes. It keeps the cables taut—under tension at all times—automatically paying out and retrieving it as required. This method not only prevents accidents but reduces the wear on the cable.

The Heavy Duty Reelite is constructed to carry cable of any number of conductors required—in lengths from 10 to 125 feet depending upon the size of the cable. It is furnished with 1" male threaded hubs and is readily adaptable for portable machines, dredges, mining machinery, track welders, etc. Reelites are also made in small sizes for use as an automatic cord retriever for portable tools.

New applications are developing daily for this cord saving device. If you want to reduce cord and cable wastage—place your problem before our engineers. You will be under no obligation by doing so.

APPLETON ELECTRIC COMPANY
1583 *Wellington Avenue at Paulina*
CHICAGO

HEAVY DUTY Reelite
REG. U.S. PAT. OFF.



Berloy Shelving in Orient Mine of Chicago, Wilmington and Franklin Coal Co.

Find anything you want instantly—

Berloy Steel Bins keep your stock in such an orderly manner, that each item, in its own indexed compartment, is immediately accessible. Compartments can be adjusted to any size quickly, thus eliminating waste space.

Fewer employees are required to handle stock; it is kept in better shape, and a visible inventory can be taken in a few minutes. Rearrangement is always possible without loss of parts.

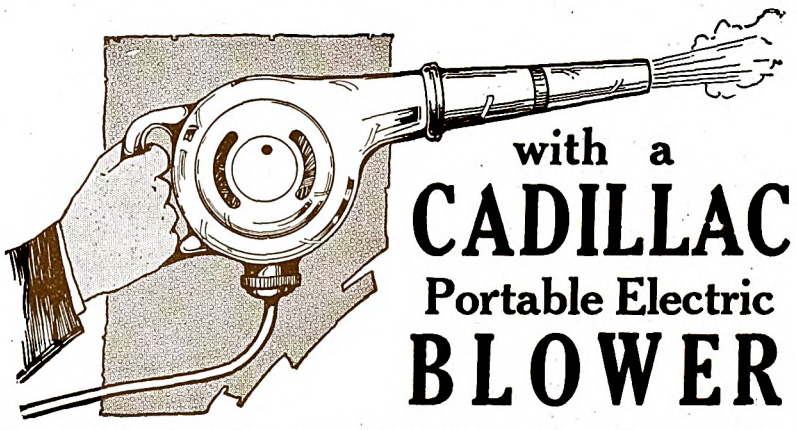
Our Catalog R-50 gives complete information. Write our nearest office for it.

THE BERGER MANUFACTURING CO., CANTON, OHIO

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BERLOY STEEL SHELVING

BLOW OUT THE DUST



with a

CADILLAC Portable Electric BLOWER

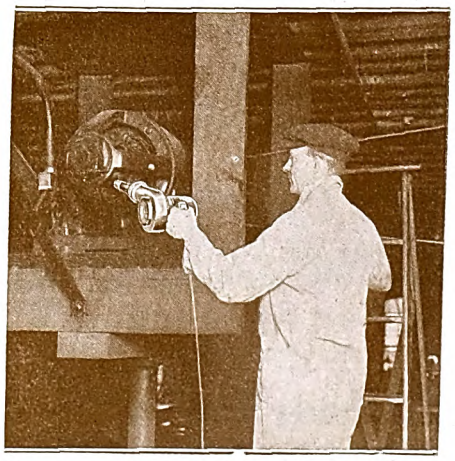
Blows dust out of motors, generators, machinery, line-shafting, stock-bins, shelves, etc. Lowers fire risk, eliminates needless waste of power in machinery by cutting down friction, and creates more healthful working conditions.

A complete unit in itself. Requires no expensive installation equipment; operates directly from electric light socket. Weighs only 6 pounds and may be carried and used anywhere. No condensation as with compressed air.

A practical, economical blower of *proved* value. In daily use by leaders in every industry.

Write for descriptive folder giving prices, testimonials by leading manufacturers, etc.

Clements Mfg. Co.
612 Fulton St.
Chicago



Cleaning small motors. No condensation to short circuit motor and no excessive pressure to injure windings or insulation.

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(Continued from page 74)

responsibilities to be liquidated by taxation of workers and producers, can be best alleviated by increasing individual production and especially by increasing the output of man-power through the service of science and invention, which should not be hampered or defeated by artificial rules and arbitrary restrictions, and

Whereas, national figures of accumulated wealth and the published records of particular lines of industry and particular industrial establishments offer eloquent evidence of the benefits derived from the introduction of scientific and efficient methods.

Therefore, be it resolved, by this Congress of the International Chamber of Commerce, that the following principles be recommended for increasing production:

1. Enlargment of production by every invention and mechanical device which offers economy of production.

2. Elimination of all artificial restrictions and recognition of the need of maximum individual output on the part of all concerned in production.

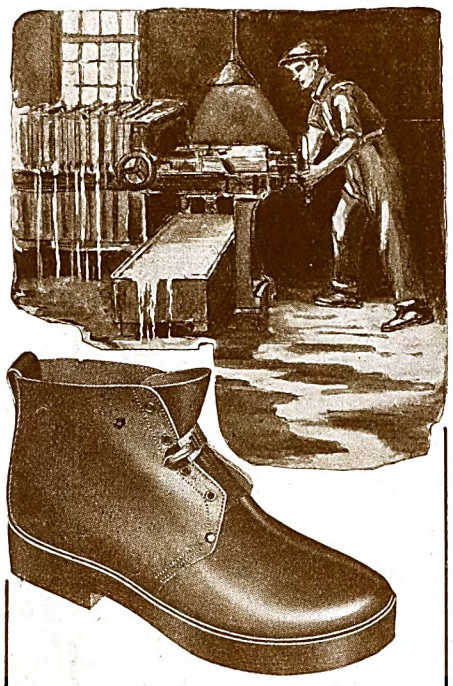
3. Stimulation of individual effort by personal remuneration based on relative individual output.

4. Governmental policies which encourage existing industries and the creation of new industries—especially by a lowering of taxation as soon as possible.

5. Adoption of governmental policies which will permit not only taxpaying ability on the part of directors of industry and workers, but also opportunity to save and give the incentive of security in the enjoyment of the earnings of exceptional ability and effort.

6. Recognition and assurance of the advantages of private ownership and operation of business enterprise as contrasted with State ownership and operation, such State operation having been proved by experience to involve burdens of unnecessary personnel and other expense, and difficulties of adjusting charges for service, all of which hamper rather than stimulate production and economy.

7. Taking immediate steps to see that men engaged in nonproductive pursuits are diverted as soon and as generally as



Cut Down Labor Turnover

Men with dry feet do better work and that's why leading industries everywhere are supplying their men with DAVENPORT WOOD SOLE SHOES.

These shoes enable men to work in comfort where it is wet or damp as in the above illustration. They are protected where acid conditions prevail and in the many other places where leather shoes or rubber boots are unhealthy.

DAVENPORT WOOD SOLE SHOES are the latest development in wood sole shoe construction. And they are oil—water — acid — dust and dirt proof.

Here is foot protection at minimum cost. Soles are fastened to the uppers with wire. All seams sewed with heavy waxed thread and riveted wherever the strain comes. Made with either buckles or laces. Vamps and uppers of tough oil grain leather. Counters of sole leather. Cushion insoles, with special construction of maple soles.

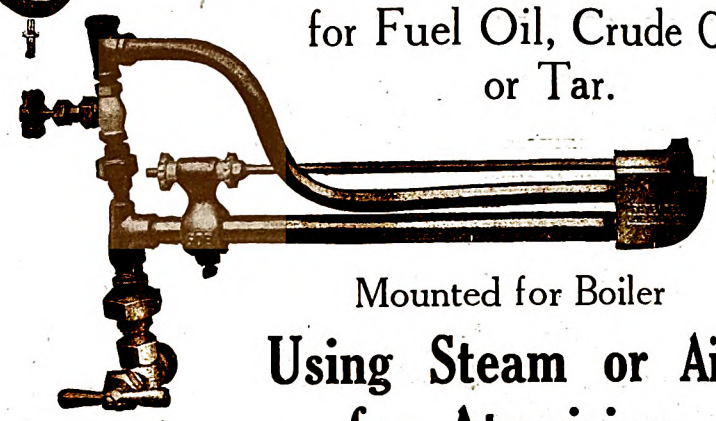
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Write for prices. Ask us to send an order for trial.

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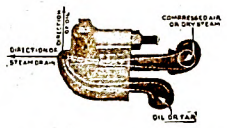
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for Fuel Oil, Crude Oil or Tar.



Mounted for Boiler

Using Steam or Air for Atomizing



CALOREX Unmounted

Note direction of arrows. The air or steam meets the oil at right angles, thus thoroughly atomizing the oil externally. This prevents *Clogging or Carbonizing.* The burner is always clean.

WE HAVE been manufacturing liquid fuel burners for the past 33 years and we can safely say that the "CALOREX" is the most economical fuel burner to operate.

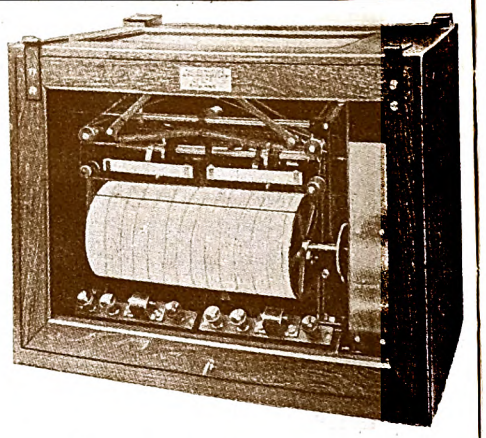
The "CALOREX" is simple in construction—no parts to wear out. It will last a lifetime.

It gives the most economical way to change boilers from coal to liquid fuel.

Write for catalog.

W. N. BEST FURNACE & BURNER COMPANY
11 Broadway ENGINEERS IN CALORIC NEW YORK
There is nothing better than the Best

CO_2 Readings from 4 Boilers on the One Chart



Helps Solve an Important Boiler Room Problem

A 4-Point CO_2 Recorder—one of the types of Cambridge Recorders, made to show the comparative efficiencies of four boilers.

CAMBRIDGE ELECTRICAL CO_2 RECORDERS INDICATORS

Save time by having a continuous record of boiler performance right in front of the operator.
They are entirely electrical—no chemicals to renew—no glass or rubber parts to break or wear out. Can be installed any distance from the flue. As accurate as an Orsat with none of its faults or maintenance troubles.
Other Cambridge instruments—Electrical Distance Thermometers. Thermo-electric Pyrometers, Optical Pyrometers, Draft Gauges.
Send for List 157 X.

The Cambridge and Paul INSTRUMENT Co. of AMERICA (INC)
MAIN OFFICE AND FACTORY OSSINING-ON-HUDSON NEW YORK | INCORPORATING CHAS. F. HINDLE | SALES OFFICE & SHOWROOM GRAND CENTRAL TERMINAL NEW YORK CITY

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possible to productive labor.

The American Delegation favored the adoption of this resolution, although in several respects they would have preferred its statements stronger and more clear in support of a theory of production which they believe is today, vital.

America realizes with all due humility the great natural resources bestowed on it by nature. It recognizes the freedom of experiment afforded it by a state of social relation free of age-old traditions and prejudices which might otherwise hamper its ready adaptation. But with all acknowledgment of these conditions which favor it beyond many other peoples, America also claims with due pride that it has developed most largely the service of enlarged production in its contribution to human progress and therefore to human happiness.

It realizes that the general average of possession, the thousand things of daily use which by division among all the people, constitute what is expressed as the "standard of living," can only be increased in the hands of the individual by production which enlarges its output more and more all the time. Moreover, that this expansion of human possession by having more things to divide can only be effectively created by producing more things per individual worker.

Aggregate production to be sure, is a thing greatly to be desired but aggregate production secured with greater numbers of workers fails of the full human service possible by expansion per individual.

It is the history of this great social development that enlarged production and especially enlarged production per individual itself creates and enlarges its own market, both by the economy of costs which follows such production and by the enlarging buying-power which follows the earnings which increased competive employment accompanying increased production itself affords the worker.

More and better food, shelter and clothing; carpets, furniture and tablewear, electric lights and appliances, phonographs and pianos, bathrooms and telephones, motion pictures and automobiles; all these owe their wider distribution in common use to this great economic process.

No truth has been so clearly demonstrated as that this practical philosophy of enlarged production contributes thus directly through human service to enlarge the means of human happiness.

To-day, the issue is directly joined between this theory of intensified production with its vast human service; and the stifling fallacy that there exists in the world only a certain limited amount of work to be done and that by restricting the output of each worker there can be more workers employed in securing this given quantity of production.

The man who in his nominal hours of work restricts and reduces the amount of effort and the amount of product which during those hours he can sustain; the organizations of men which designate and limit a day's work to be the laying of 300 bricks when a fair workman could lay 1200; the organizations of men, that by the power of concerted action, force observance of arbitrary rules requiring several men in the discharge of tasks, other-



Coal and Ashes Handling Simplified

You can make the work of delivering coal to your boilers and disposing of the ashes one of the easiest tasks in your power plant, and at the same time reduce the expense to a minimum.

Handle them with Webster Conveyors, and combine the advantages which mechanical handling affords with the further advantages accruing through the general serviceability and low cost of operation and maintenance of Webster equipment.

We make all types of equipment for coal and ashes handling from the highly perfected Perkins Pivoted Bucket Carrier to the simplest flight or belt conveyor. Ask for one of our engineers to look over your present conveying methods.

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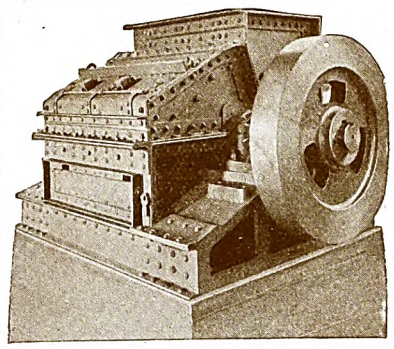
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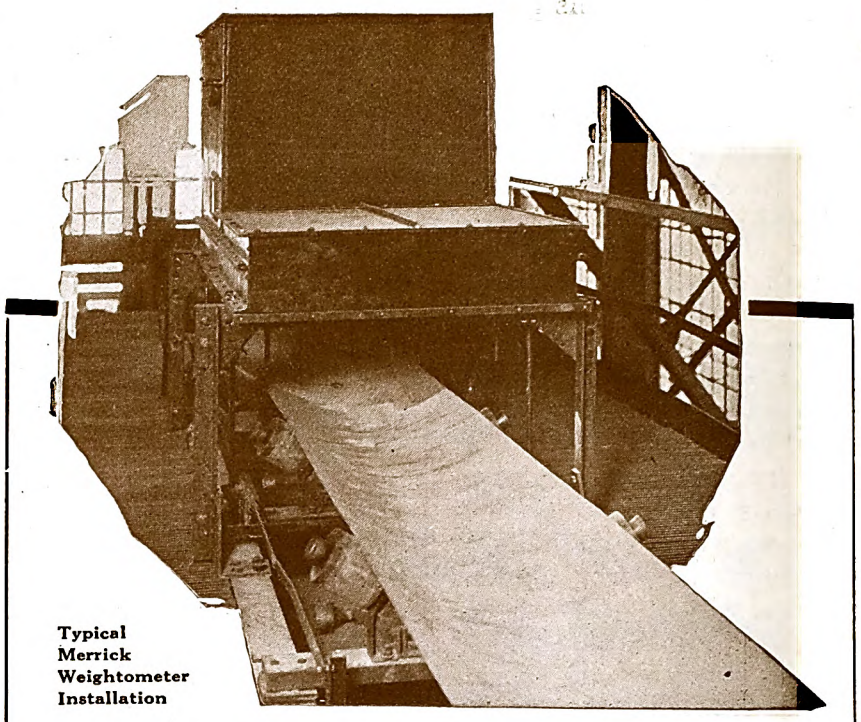
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WEIGHS WHILE IT TRAVELS

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Dissecting the Good Old Rules

By P. M. Fogg

PONDEROUS platitudes have their place in our lives. We all need the occasional stimulus of mental "bitters" to tone the fagged will. An injection of psychological "dope" now and then stirs up the rheumatic props of purpose to greater activity. For human nature is prone to sag in the middle.

Yet, as in the case of all medicines, judgment should govern the size and frequency of the dose. Caution must be observed lest the wrong bottle be selected in the dark. It must not be supposed that cure-alls are existent for any and all mental ailments.

Many a discouraged, heart-sick worker who has faithfully followed the good, old rules as laid down in the text books, is wondering today why they do not seem to work out in his case. With honest sincerity of purpose he is throwing himself heart and soul into his job, determined to win. He has perhaps been doing this day after day, month after month, and year after year; and he has been giving the very best that is in him. Yet he is still so close to the bottom of the ladder that he can easily reach down and grasp the hand of the chap who hasn't even begun to climb.

The rule book says, "Plenty of room at the top." The magazines tell us how the big executives have strained their eyes looking for the man to whom they can safely entrust that ten thousand dollar job. Employers wring their hands and cry, "If only the employee would prepare himself for the job ahead of him, then when the golden opportunity comes—that is, when his boss is promoted or resigns,—he will be fitted to step right into the place."

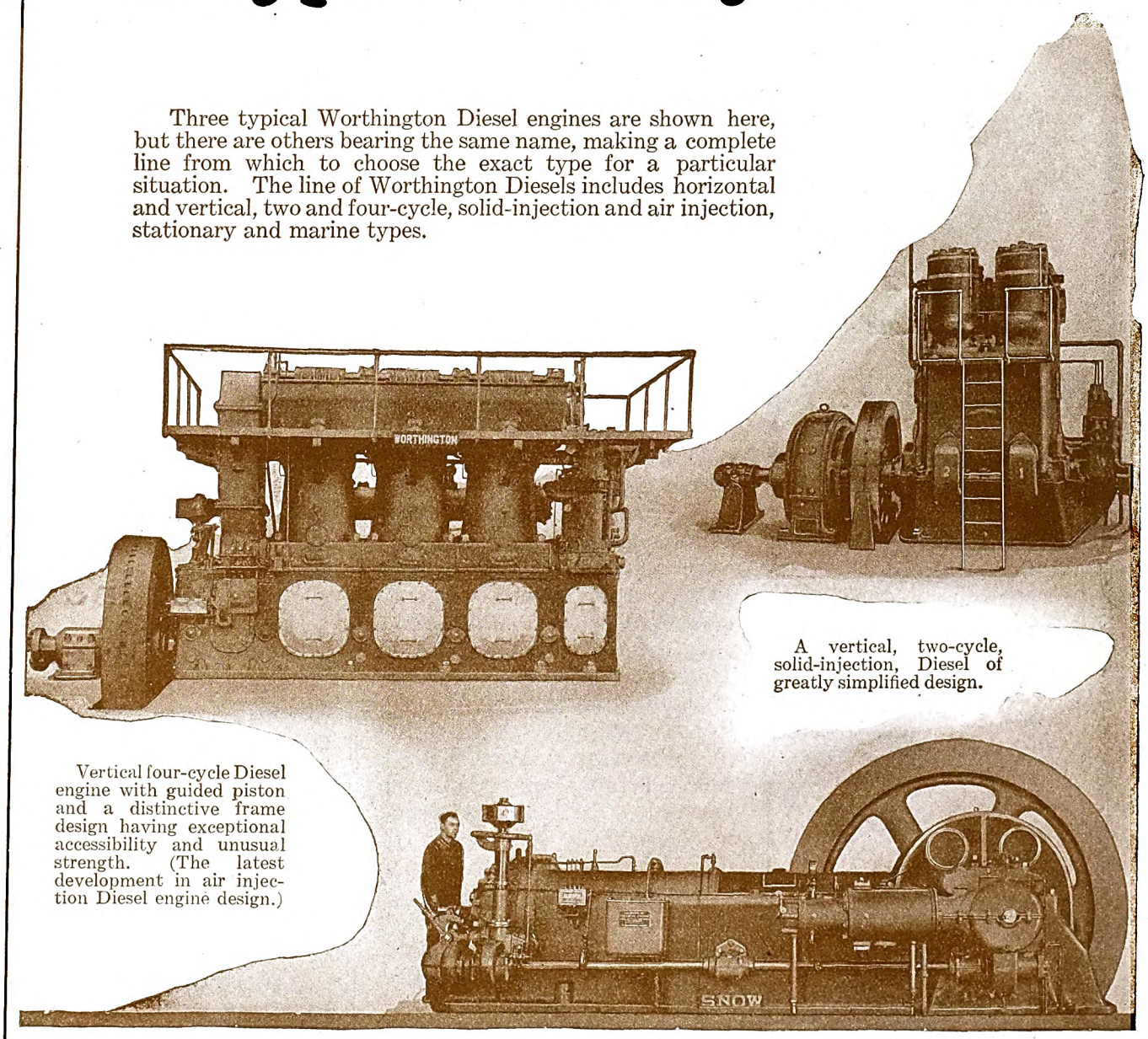
Meantime George slaves over his ledger, and Nellie continues to sell ribbons, and Harry is still driving the truck.

George notes with some cynicism that his boss, the head bookkeeper, is likely to stick where he is for life—his ambition having expired long ago. It looks very much as though the road ahead is blocked. Nellie can see no light ahead in her little groove. "I have a fat chance of landing the buyer's job here," she says, "even if I do know as much about ribbons as the factory does." And Harry can see himself grown grey headed before he can progress more than two short steps above a truck driver's position.

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say to these worthy souls that they are the exceptions to the rule. No rule can be all-inclusive, we may tell them. We point to the ones who have advanced; we extol their thrift, expert knowledge, and ability to think for themselves. "These are the ones," we reply, "whose records indicate the functioning of the rules. Go and do likewise." Then we pass out the little pamphlets of inspirational literature.

In justice to themselves, what should the workers think of all this? What are the facts as found in the average place of employment?

Not long ago, a frank, illustrative statement appeared in one of the periodicals devoted to industrial management. It had been written by a factory manager, and was of a nature to jar severely the serenity of the pet theories. For it stated that in any large industrial organization the great body of workers hasn't a chance large enough to be found with a microscope, to advance in accordance with the time honored rules. The exceedingly small percentage selected to become foremen, managers and presidents is virtually negligible. Not a chance in the work to which they are giving the best part of their lives! This is only another way of saying that the mill hand, if he ever aspires to become anybody of consequence in the business world, must quit being a mill hand, and become something else. The highly complex condition of industry offers opportunity to but very, very few of those in the lowest stratum. Such jobs must be looked upon as something to be escaped from at the earliest opportunity, if the worker has initiative.

We all know this to be a fact, but it doesn't sound pleasant, and it is disturbing to our faith in the good, old rules to have somebody blurt it out in cold print.

It may be argued that far too many wage earners are not properly located in society, with regard to their individual abilities or latent talents. Granted, and yet our factories continue to operate and the mills to turn out merchandise. Society is using the worker, whether or not he is properly situated economically. And we have only begun to give serious attention to his having



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selected the wrong job. Yet we continue to point out that by virtue of unremitting toil, and the force of will power and sheer grit, the worker may some day direct the great wheels of the industry in which he plays a small part.

Go into the office where George is bending over the ledger sheets and glance at the white collared chaps. Is it always the hard worker, who is just a step ahead of his job, keen and alert; is he the one who always finds himself singled out for promotion or for advance in salary? Ask the gray headed man who faithfully guarded his employer's interests for years, in his own little niche, only to see a smooth talker from outside the ranks slip into the vacancy at the top, and proceed to make a showing of economy by reducing the force. Those with records of five, ten, or fifteen years of service—out they go along with others. Perhaps they are a little too old, or it may be that their salaries look too high to the new manager.

Talk with the embittered ones who have seen favoritism stalk unhindered when advancements were being distributed. They will tell you that in their own cases at least, the rules cannot be taken at their face value. Office politics, a close friendship with the boss, a little flattery here, subtle influence there, similarity of organization membership, or perhaps an old grudge still smouldering—all the frailties of human nature are as likely to be present when the worker's opportunity arrives, as are the remembrances of faithful efforts to rise through adherence to the policies of the rule book. It would seem that a precept which is good for the worker to follow ought to dovetail into an equally good one for the manager to recognize.

The truth of the matter is, that we have all been schooled from infancy to look to the very top of the peak as the only worth while goal. Thus we have been prone to consider the road along which we are travelling merely as a means to an end—something to be passed over as quickly as may be. Every boy is solemnly told that the Presidency of his country is open to him, just as to every other native born citizen. He is encouraged to keep his eye on the job ahead of his own, so that some day—some day—he may become the head of the firm, "Stay where you are, and grow up with the place; don't jump around from one job to another," he is advised.

The boy advances to manhood, if to nothing else, and if he is willing for others to do his thinking for him, as many are, and finds after some years of service that somehow the rules have not proved themselves in his case, he is apt to become a sour, disgruntled individual.

If the boy had been taught to believe that the rules are theoretically correct, but that in all but a pitifully small number of cases the worker must find his chief satisfaction in work well done, in service performed to the very best of his ability; would this not help to create for him a more satisfactory type of philosophy?

In only one case out of a thousand will the worker ever be known except by his check number or as Bill Jones, the clerk. There will be no swivel chair, no limousine, no handsome salary for but a very few. Then why not lay the facts before the boys from the very start? Why not train the thousand future workers to be happy at being efficient in little jobs? All but one of them will remain in a comparatively small job. Why should we take steps to create discontent through false hopes?

Society must always have the lowly worker—the man who sweats in the dirt, dust and grime—the chap at the bottom of the ladder. And we shall always have our rule books with their inspiring phrases. These rules are not wrong in principle, but actually they will never apply but to the very few. If we add to them inspiration for even the lowliest to absorb, and teach him to be happy in the realization that "he also serves who only stands and waits," then we shall have created a wider field for the cultivation of contentment. For "many are called" to serve, "but few are chosen" to lead.

Measuring the Product or Measuring the Man

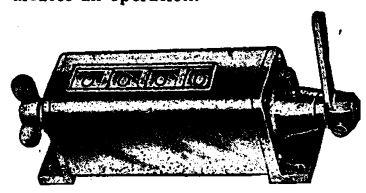
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In its effect on *results*, getting the *workman's* measure is the more important, for the fact that you have his production-record on a counter assures always a *better* record than otherwise.

So look for more than accurate records; look for substantially more *PRODUCTION* from

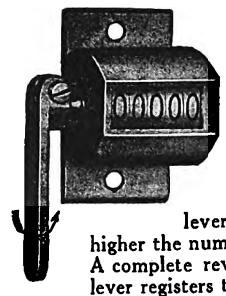
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This small Rotary Ratchet Counter (No. 6) counts reciprocating movements of the lever, as required for recording the output of innumerable small machines. When the lever is moved through an angle of 40 to 60 degrees, the counter registers one. The further the lever is moved, the higher the number registered. A complete revolution of the lever registers ten. This counter can be adapted to no end of counting purposes, by regulating the throw of the lever. Price, $2.00. (*Cut nearly full size.*) Small *Revolution* Counter also $2.00



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A Scene in the Cleveland Steel District

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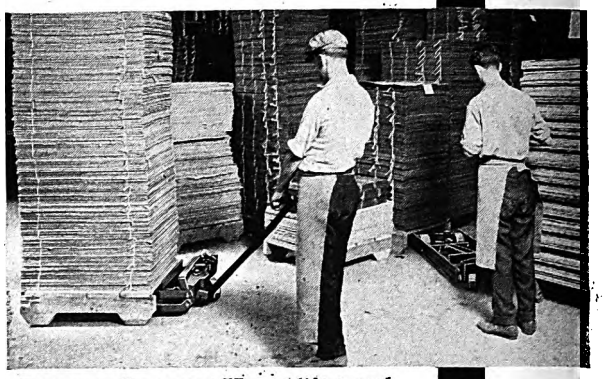
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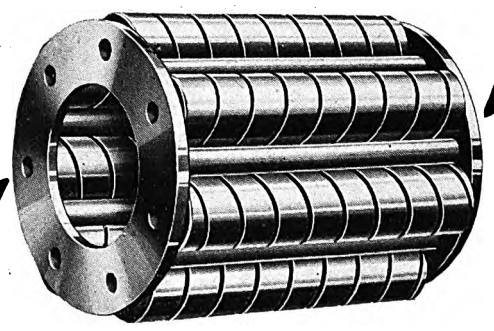
Steubing Hyatt equipped lift truck.



Cowan Hyatt equipped lift truck.



Lewis-Shepard Hyatt equipped lift truck.



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The illustration on this page shows pulverized-coal-fired boilers in the Lakeside Plant of the Milwaukee Electric Railway and Light Company.

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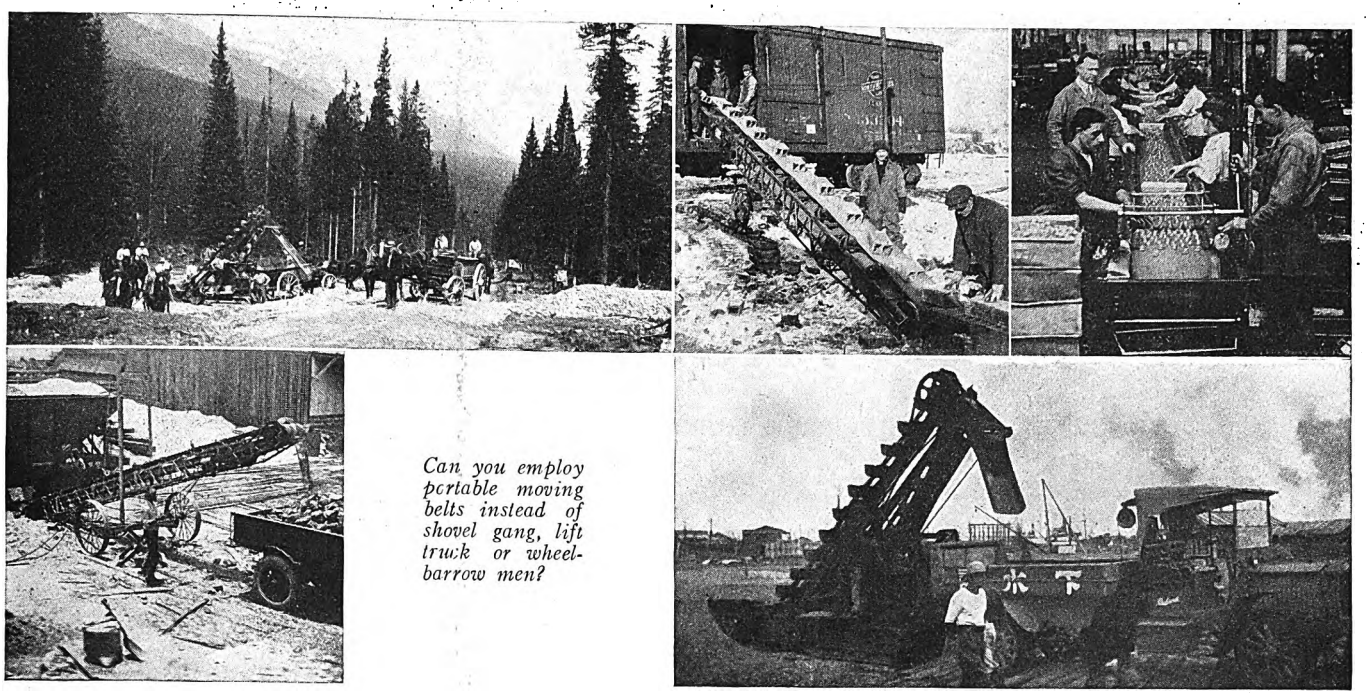
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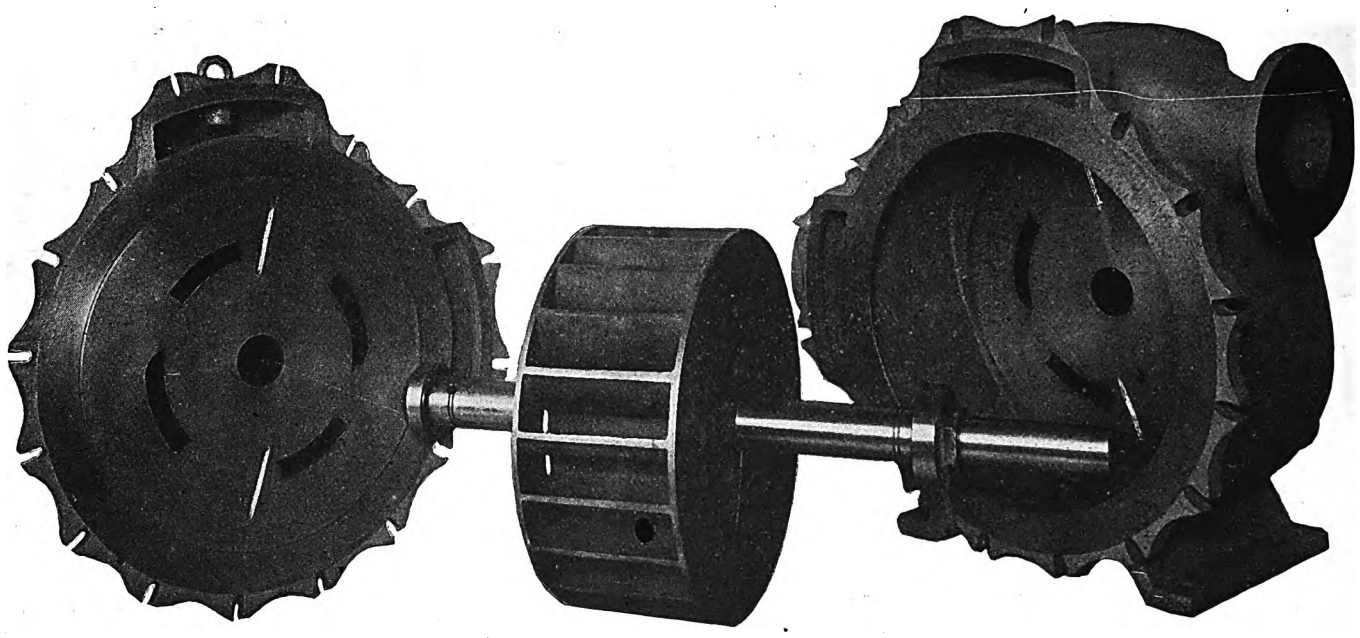
Portable Belt Conveyors — Self Feeding Bucket Loaders

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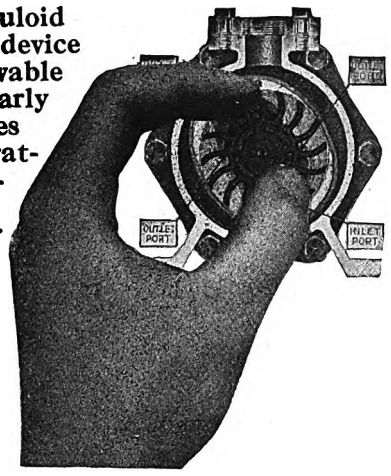
They run without vibration.

The cost of installation is greatly reduced as no expensive foundations are necessary.

No expert attendance is required as there are no adjustments to make. The cost of upkeep is negligible.

Hytor compressors are quiet in operation.

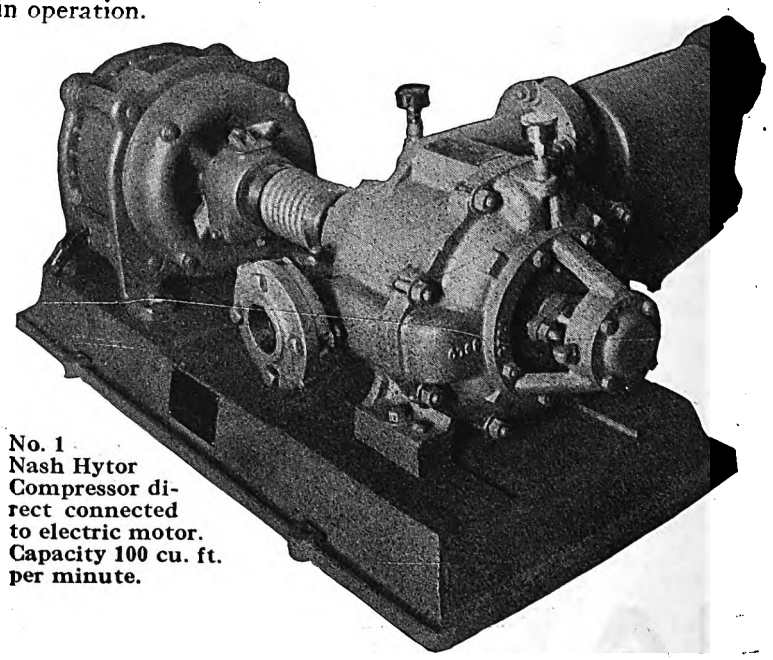
This celluloid graphic device with movable rotor clearly illustrates the operating principle. Send for your copy.



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Industry Illustrated

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EDITORIAL

The Key to Progress

IN the opening chapter of his great work, *The Wealth of Nations,* Adam Smith shows how manufacturing productivity was multiplied by the division of labor. He cites the case of the manufacture of pins; pointing out that in a small factory employing ten men, each man doing only one or two of some eighteen distinct operations, the production is upward of 48,000 pins a day or 4,800 per man—whereas, were each of the ten men, without specialized training, to perform all the operations, they probably could not produce twenty pins each per day.

Adam Smith's book was first published in the year 1776, the same year in which this nation was born. An odd coincidence, because America, more than any other country, is responsible for the mechanicalization—the replacing of men by machinery, the use of steam and water and electric power—which (to use the illustration he cites) today accounts for a production of almost 150,000 pins a day for each man employed in the industry.

Most of us in this busy hive that constitutes American industry are too busy to pause and consider; we are so occupied with the immediate present that we have scant time to review the past or to speculate intelligently concerning the future. Yet it would be interesting and instructive if some present-day Adam Smith would lay before us as well-reasoned an analysis of the complexities of modern civilization.

The "average" man of one-hundred-and-fifty years ago lived and worked and died within a circle of perhaps twenty-five miles in diameter; he learned of events a few hundred miles away only after the lapse of days and sometimes weeks; news from overseas reached him months later, by sailing vessel, news from overland by post-chaise or a-horseback; and these, or his own feet, furnished his only means of travel.

We have always with us the professional reformer, who would make the worker's life a Utopian paradise overnight; we have the agitator, who would bring about the six-hour day by means of a "proletarian" revolution; we have the demagogue, who performs eternal lip-service for the common people. These are the ones who, in all the ages, and in various guises, have held the spotlight and monopolized the prayers and hurrahs of the unthinking.

But all the while without any blare of trumpets, a steady, purposeful evolution has been taking place in civilization. And it is industry—not the professional reformer—which has transformed the worker's life; it is industry—not the radical agitator—which has made the eight-hour day a fact, and the six-hour day a possibility of the not-too-remote future; it is industry—not the demagogue—which has, through multiplying man's productive power, bettered the lot and broadened the vision of the common man.

Doubtless the reformer and the agitator and the demagogue will continue to hold the attention of vast sections of humankind, for the human mass-mind works that way. And doubtless industrial evolution will continue on its slow, steady progress; for that is the way real progress has always been achieved.

Bringing together men with the will to work and men with the vision and capacity to direct, and calling upon science and inventive genius to supply the machines and the power—that is what multiplies man's productive capacity; that is what makes possible shorter hours and lightened labor, more earning power and greater recreation, better education and consequent higher standards. And that, in sum and substance, is industry.

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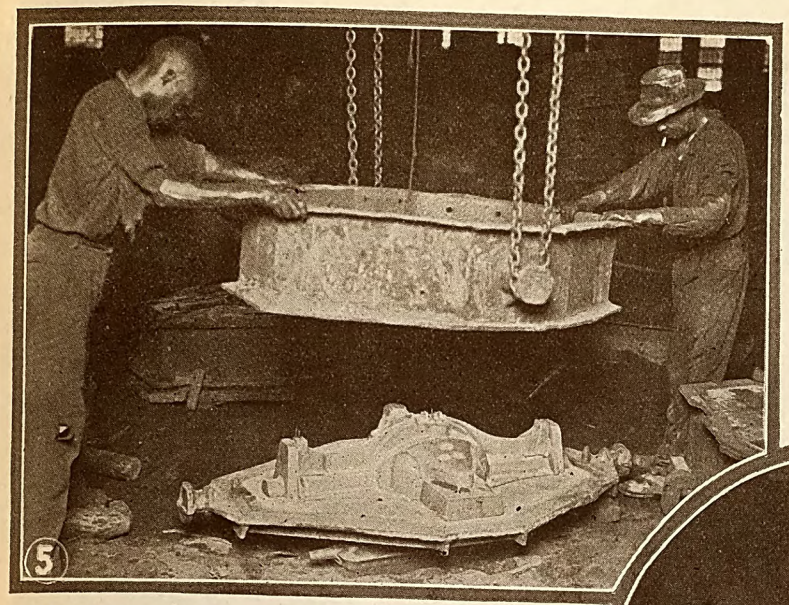


Fig. 5. One-half of the pattern is here shown on the plate; the flask or container being lowered around it in order to permit sand to be packed around the pattern. When this is done, the flask will be turned upside-down, the bottom plate (which holds the pattern in place) will be removed, and the pattern carefully pulled out; leaving an exact reproduction of the pattern in the sand.



Fig. 6. Ramming one section of a mould. The iron outside form is known as a flask; its mission being merely to form a wall or container to hold the sand. Each part or section of a mould is so made and then these sections are placed together, making one complete mould for reproducing the object wanted.



Fig. 7. Showing how the pattern is carefully drawn from the sand, leaving an exact reproduction of the pattern in the sand. This vacancy will eventually be filled with molten metal.



Fig. 8. Setting a core. The object which these men are lowering in place is a sand form, or core. When the metal is poured into this mould, it fills up everything except where there is an obstacle, such as the core. When the metal becomes solidified, the sand core is removed, leaving the desired hollow or hole.



Fig. 9. Here is shown a finished section of a mould; the pattern having been drawn from the sand, leaving its shape and impression therein. The operator shown is drying the sand surface, or skin.



Fig. 10. **Closing a mould. Placing one flask,** containing one section of the mould, on top of another; thereby making or building up complete the shape desired for the finished casting. The cores (which will, in the finished casting, be the holes) are very plainly seen.

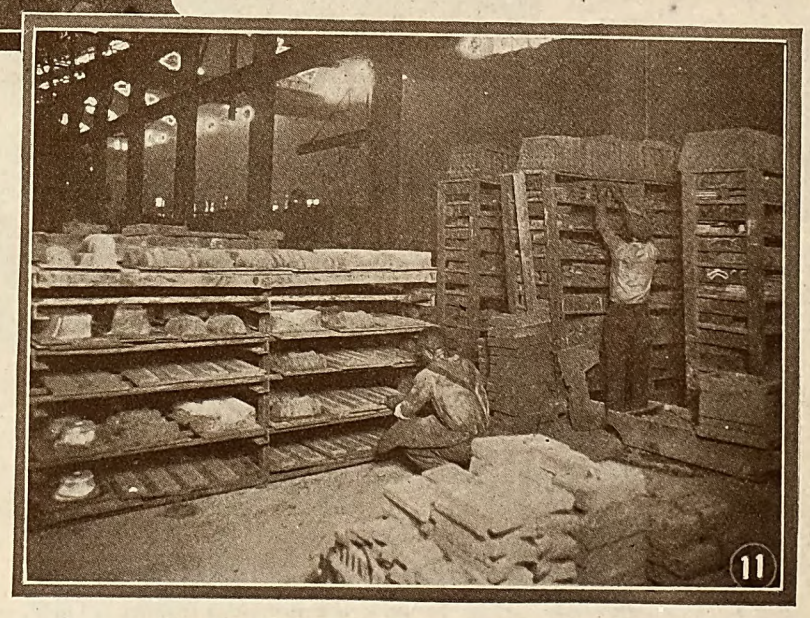


Fig. 11. Core room, showing how cores are held or stored until needed. These cores are merely well-baked or hardened forms of sand properly compounded and shaped to the size of the holes or hollows that will be wanted in the finished castings.

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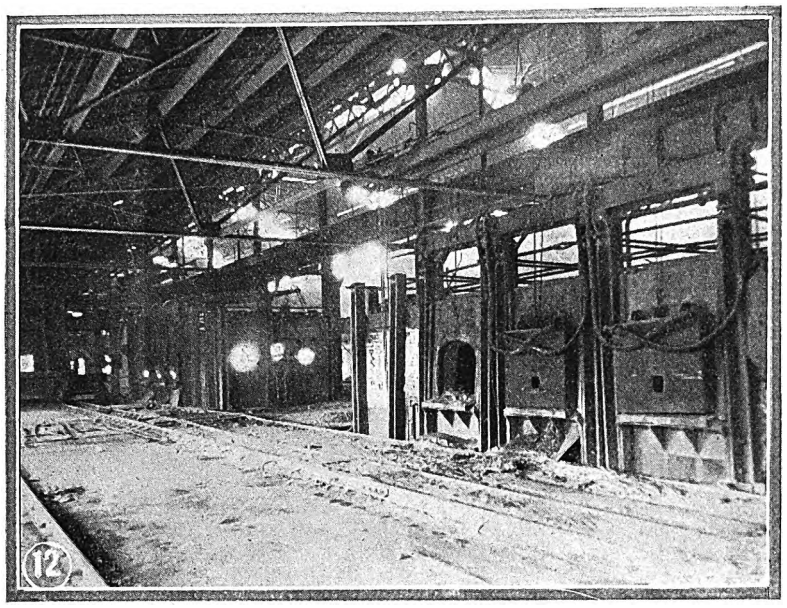


Fig. 12. The open hearth furnace. This shows the charging side of two 20-ton open hearth furnaces. When the furnace is charged, the three doors are lifted as required, and the pig iron, scrap and other ingredients are dumped or thrown into the furnaces through these doors. It requires about four to six hours to melt a heat.

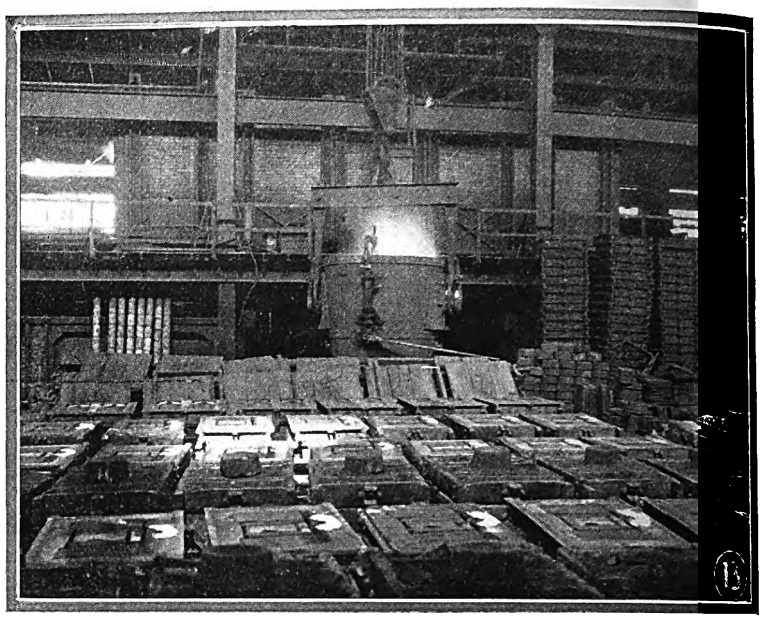
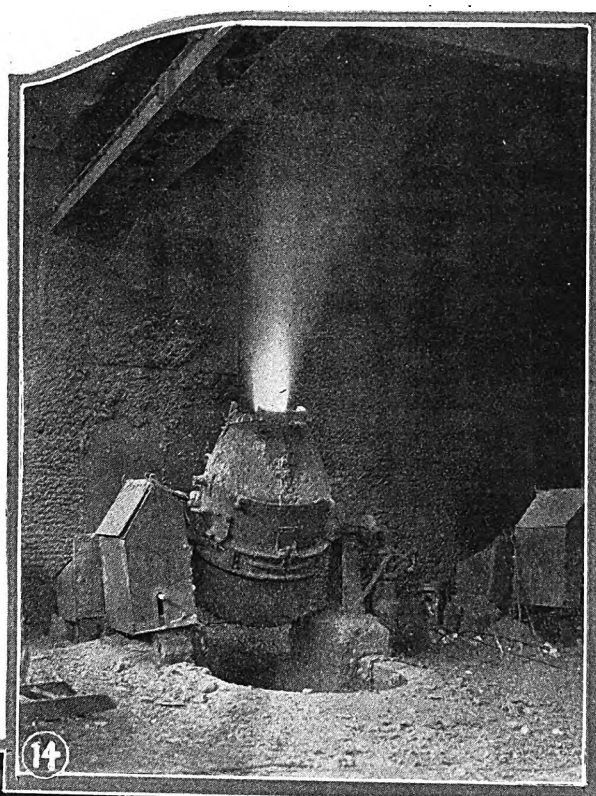


Fig. 13. Tapping side of an open hearth furnace. When the molten metal inside is ready, of the proper analysis, a hole is forced open in the furnace at the spout, and the molten metal permitted to flow into a ladle. The ladle is then lifted by a crane and carried to the respective moulds and the necessary quantity of metal allowed to flow from the controlled hole in the bottom of the ladle, into the hole in the sand mould.

Fig. 14. This is a converter in the midst of "blowing" a heat. The furnace or converter is pear-shaped and is held on two arms or trunions. When it is being charged with the molten metal from a cupola, it is permitted to lie on its side, the mouth being up. The instant it is charged, a tremendous blast enters the bottom, the vessel is turned up, and the chemical reaction begins, as shown in the illustration. When ready, the contents are poured into a ladle and handled as in the open hearth process.



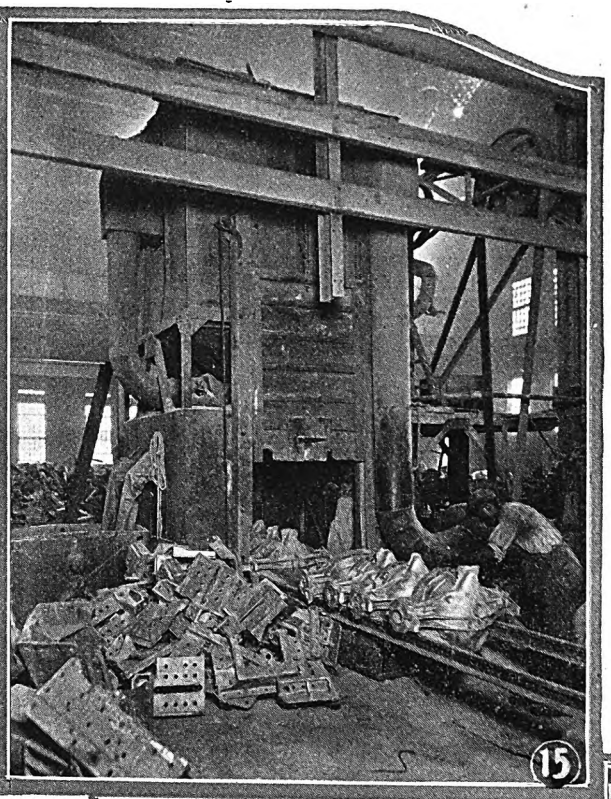


Fig. 15. Sand blasting. Here the castings are placed in a large container and subjected to a severe blast of fine sand from all sides. This cleans and removes all scale, or hardened sand, oxide, etc., which may have adhered to the surface of the casting.

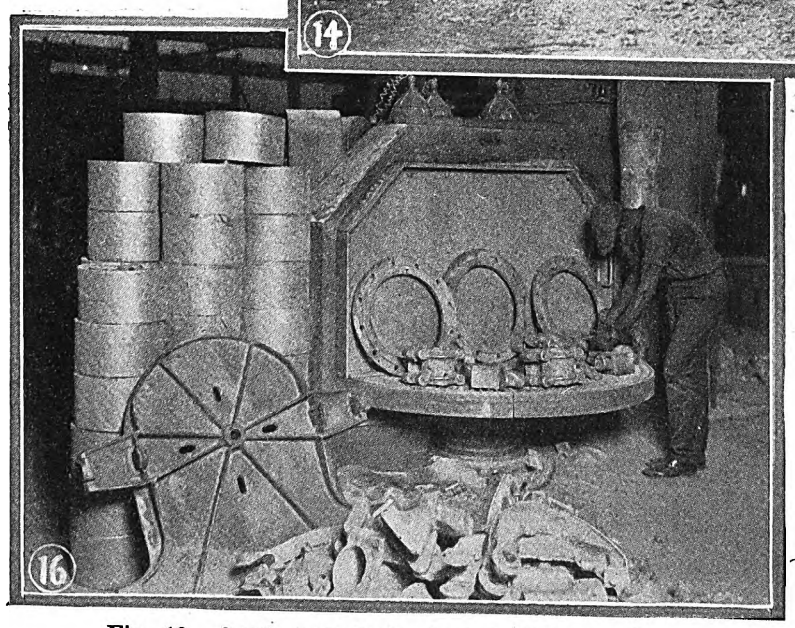


Fig. 16. Another method of sand blasting. It consists of a large turn table, one-half being inside the machine where the sand blasting is taking place, while the half that is outside is being unloaded and reloaded. It allows a continuous operation.

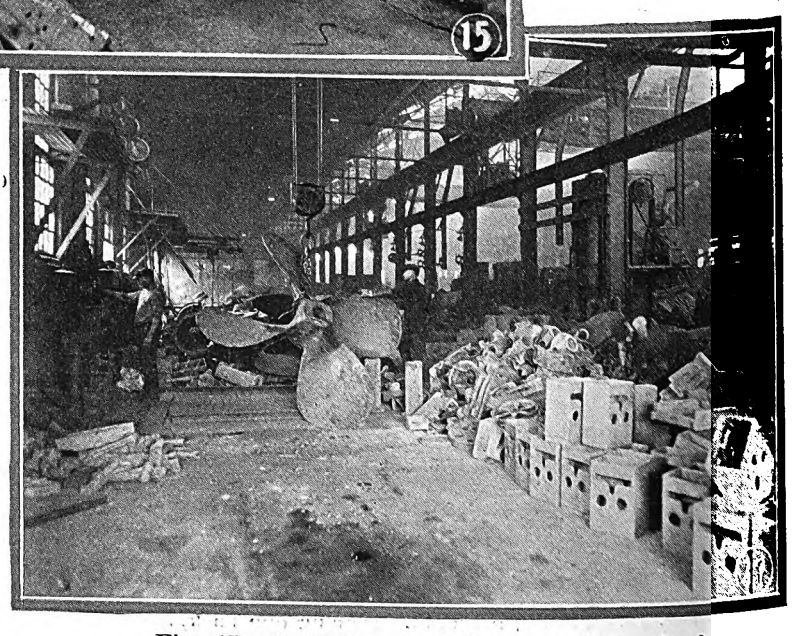


Fig. 17. Weighing a finished casting. Steel castings are priced by weight and fineness of quality; the cost being influenced, of course, by the intricacy of the casting. This latter is apparent when we take into consideration the making of patterns and moulds.

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He Chased the Rainbow—Caught It—and Put It to Work

Frederic Eugene Ives, Prolific Inventor—Father of Half-Tone Engraving

BY ERNEST H. ROWE

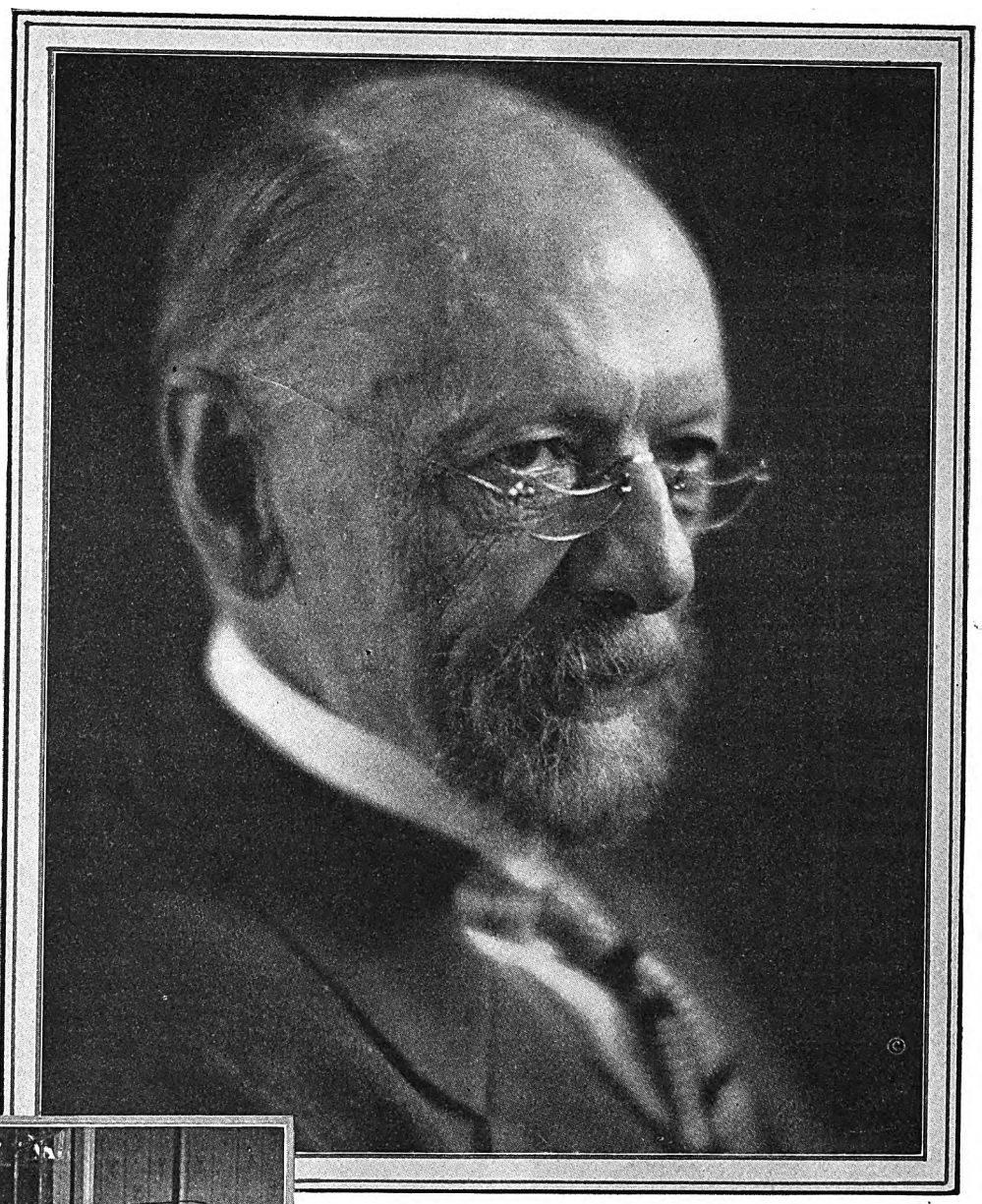
THE sixth decade of the nineteenth century seems to have been exceptionally active in attempts to take the pictures made by the still new art of photography and reproduce them by some process which could be used on the printing press. Nature took a hand in the activity by bringing into the world, on the seventeenth day of the second month of the sixth year of that decade, a man child who, by the time he was twenty-two years of age, solved that problem. She selected the old New England town of Litchfield, Connecticut, and the old New England family of Ives for his birthplace and parentage. They christened him Frederick Eugene. Several of his active years as an inventor were spent in London, England, and in the New Jersey towns opposite uptown New York, but now he lives in Philadelphia. Perhaps he moved there so it would be more convenient to step into the Franklin Institute for the medals it awards him every now and then for his inventions and discoveries in optics: color photography, motion pictures, lenses and apparatus of great variety. Several other scientific societies have bestowed their medals or memberships upon him, and the United States Government alone has granted him nearly a hundred patients to date.

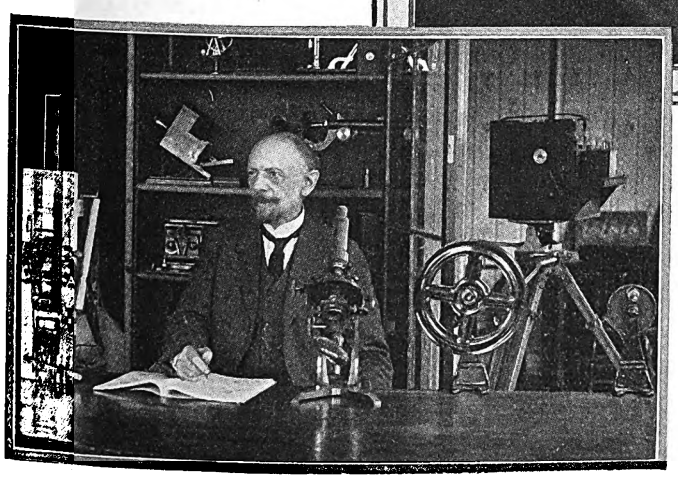
But one thing he lacks—a college degree. Because he never went to college. So, he isn't "educated." But most certainly he is learned. Formal "education" is not to be despised, by any means, but its absence does not debar anybody from gaining its equivalent if he but will.

Today's school boys are fooling with radio. Young Ives was just the same kind of a boy, who tinkered with what was then the scientific curiosity, the "little black box" that somehow took pictures. He had his "home-made set" fashioned of a cigar box with spectacle lenses. Wouldn't that camera be a treasure for some museum, to be gazed upon in wonder by present-day and future press-the-button amateurs who often do not even know the names of the materials with which they so easily snap-shot anything they can see and want to "take" so they can see it again at pleasure?

Litchfield is a town with atmosphere: Colonial, Revolutionary, historical, learned, religious, American, Yankee atmosphere. It is not hard to imagine that a childhood spent there would be almost the equivalent of a college education. In the struggles which attended the birth and early development of this nation, Litchfield was no mean city. Its impress upon our institutions is not measured by its pres-

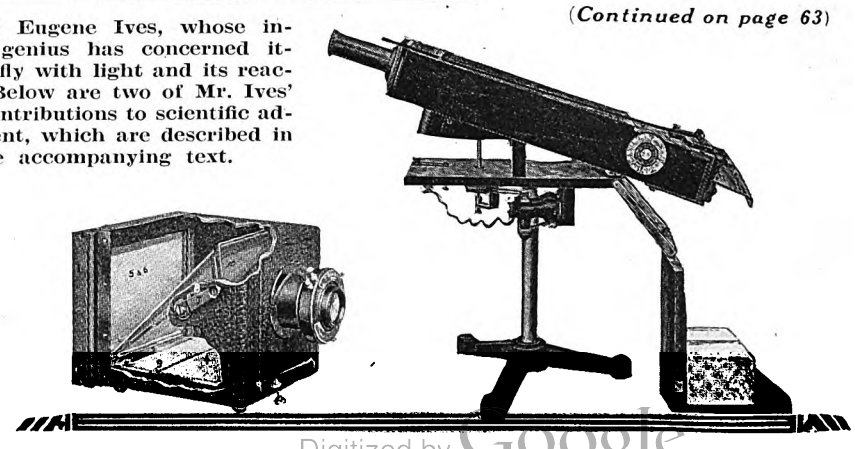
(*Continued on page 63*)





The inventor, amid familiar surroundings in his laboratory.

Frederic Eugene Ives, whose inventive genius has concerned itself chiefly with light and its reactions. Below are two of Mr. Ives' many contributions to scientific advancement, which are described in the accompanying text.



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The Elimination of Re-Handling

How the Lift-Truck and Skid System Cuts Handling Costs

By Matthew W. Potts

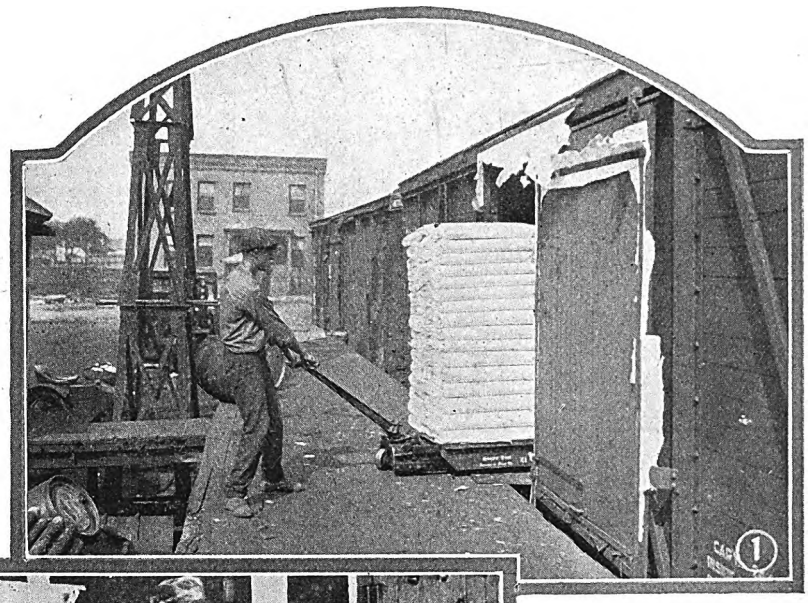


Fig. 1. Car unloading with skids and lift trucks is simple. One truck will handle a number of skids without delay, waiting for loading and unloading.

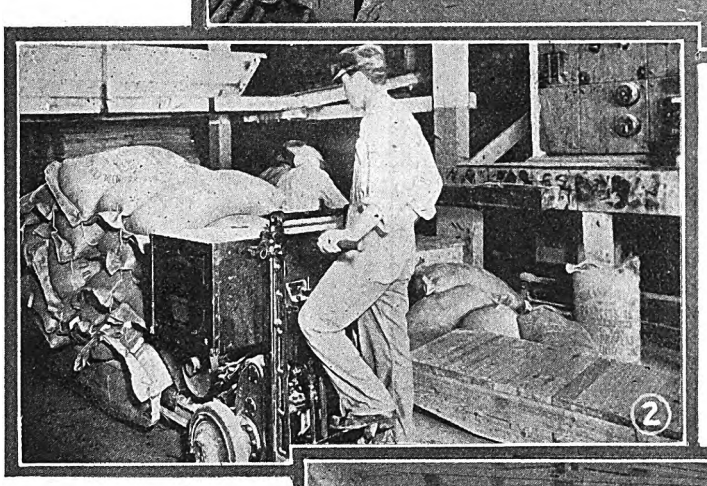


Fig. 2. The electric lift truck picks up the loaded skid within the plant. Empty skid shown to the right will then be loaded with bags.

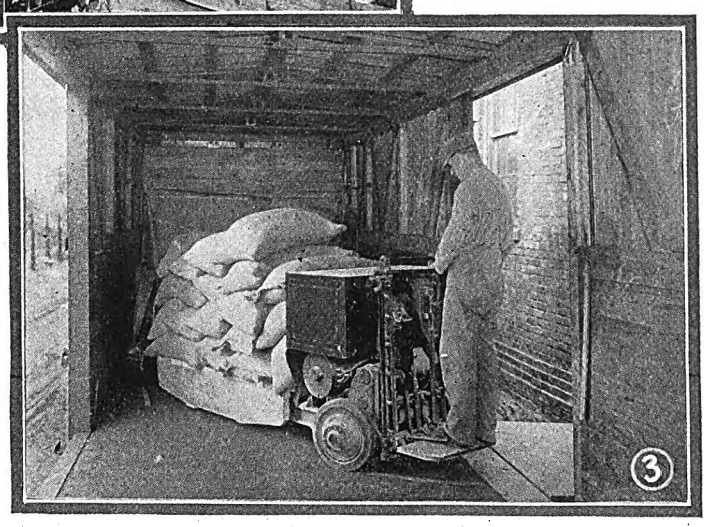


Fig. 3. Without re-handling, the load shown in Figure 2, is transported directly into the car for stowing.

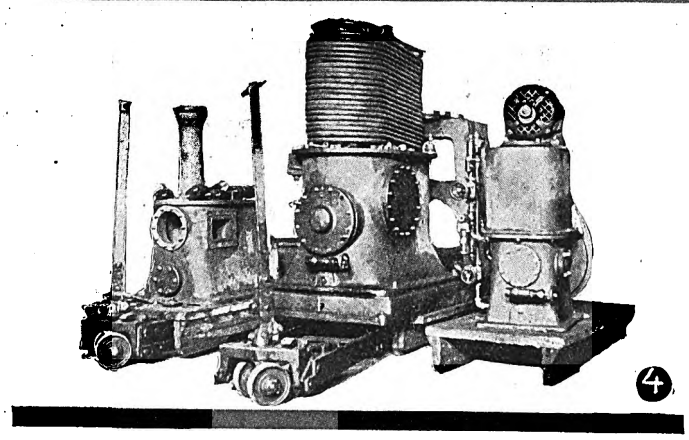
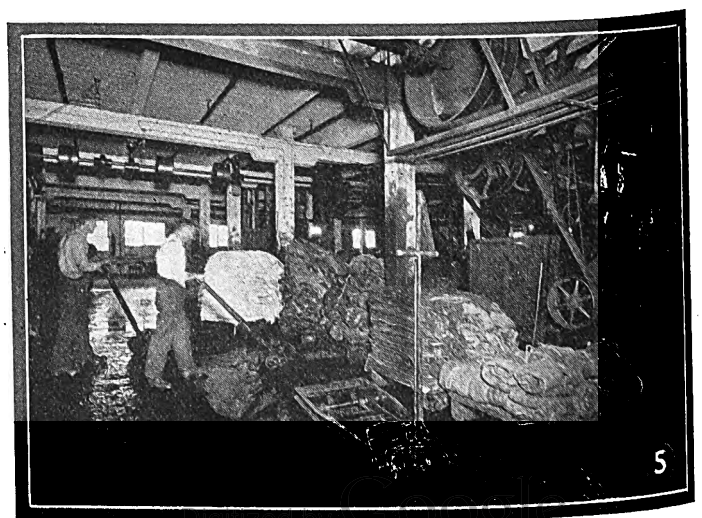


Fig. 4. Heavy machinery assembled on skids can be quickly moved from place to place by hand trucks.

ONE of the commonest jobs in any manufacturing plant is that of a trucker. The commonest of common labor seems fitted for this work. The principal requirement is brawn, and plenty of it. No attention is paid to what the men have from the neck up; so the movement of materials about the plant, and from one department to another is delayed, and the work of skilled workmen hampered, with a subsequent lessening of production. Desperate measures have been resorted to by some manufacturers, the number of truckers increased in some instances, so that the men are actually in one another's way. The result of such practices is to cut down productivity still more.

There is one way out of the difficulty; to use mechanical equipment for moving goods. One of the most versatile systems for this purpose is the elevating platform truck with skids. Piling and re-piling, handling and re-handling is the cause of waste and expense in the old style trucking. It takes time and labor to set up and tear down a load, and with the ordinary type of platform hand truck, and platform power-driven truck, this setting up and tearing down is absolutely necessary. Moreover, this piling and re-piling is done not once, but several times in most factories, from

Fig. 5. Tanneries are severe on all classes of equipment, due to acid conditions. The use of lift trucks and skids materially reduces truck maintenance expense.



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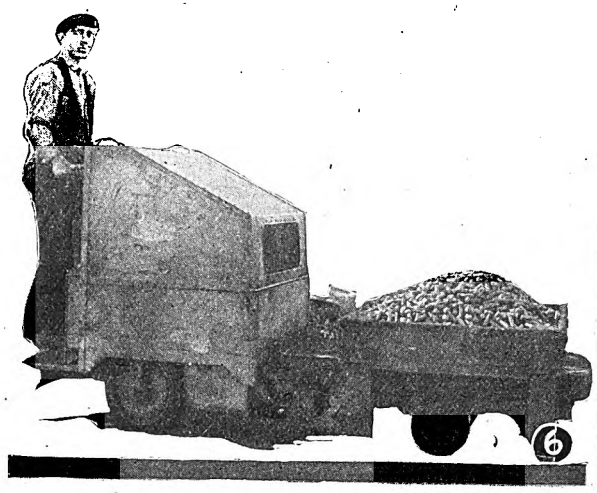


Fig. 6. This illustration shows a gasoline lift truck performing practically the same work as the electric storage battery lift truck in Fig. 7. The type of truck to be used depends largely on operating conditions.

the receipt of the raw materials to the shipment of finished goods.

Elevating hand trucks and elevating power trucks are fundamentally self-loading devices, and by allowing the loads to remain on the skids, eliminate many loading and unloading operations. The lift trucks and their skid accessories have probably caused the most radical changes in plant operating methods, and the greatest economies in non-productive labor costs, than any other type of mechanical handling equipment.

Manufacturing concerns that have installed this type of equipment report large money savings in direct labor costs. The operating superintendent of one plant reported that the use of electric elevating platforms and skids had proved so beneficial that they were able to show that each electric truck reduced direct labor costs $800 per month, over old hand methods.

Another concern handling large rolls of paper has been able to demonstrate that their use of lift trucks and platform skids has effected a savings in labor costs of $21,000 per year. These are only two of the many installations that are now operating successfully in all types of industries, but they show the enormous reductions that can be made in costs, by using mechanical equip-

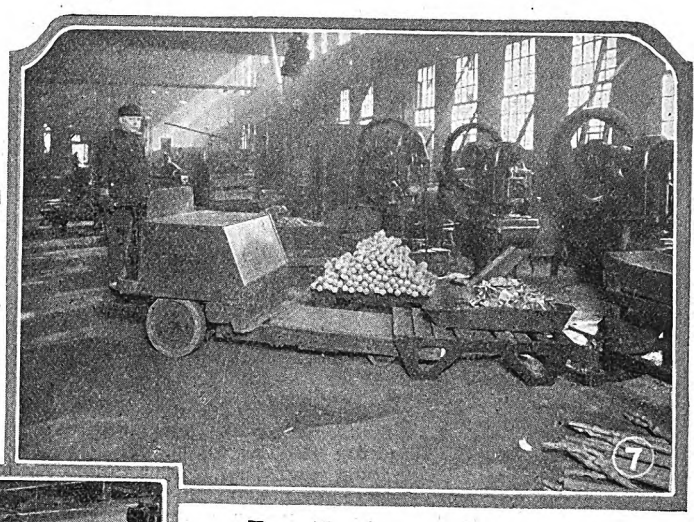


Fig. 7. Machine shops have found the lift truck system advantageous. If these skids were equipped with racks for holding material, they would no doubt be more efficient. The construction of the skid is sturdy.



Fig. 8. Pressed steel skids are becoming more common, due to their practical indestructibility.



Fig. 9. The handling and re-handling of sheet tin is difficult and dangerous. Skids and lift trucks permit one handling from car unloading to point of consumption. This shows the stock room in a large can company.

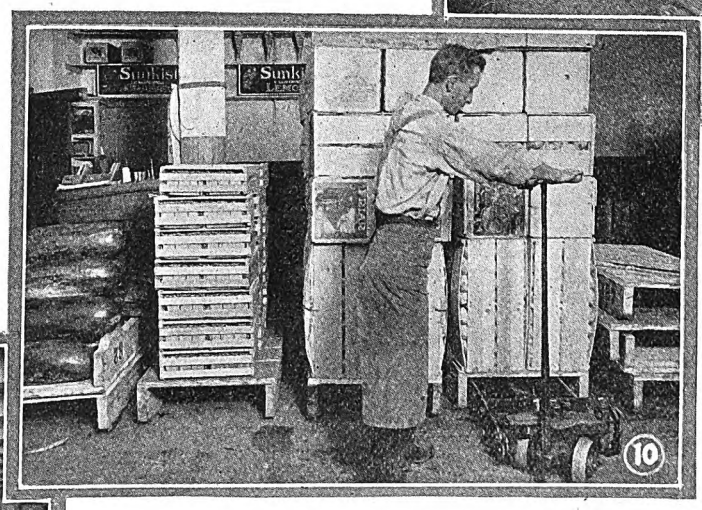


Fig. 10. The use of skids is not limited to any one industry, and can be used just as advantageously on produce, as on machine parts.

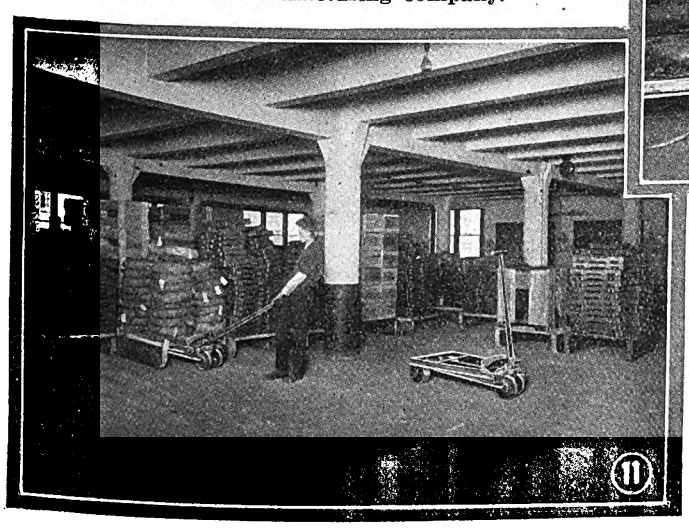


Fig. 11. Storing materials in the stock room on skids greatly reduces warehouse labor and facilitates quick movement of materials. This is the warehouse of a large electric manufacturing company.

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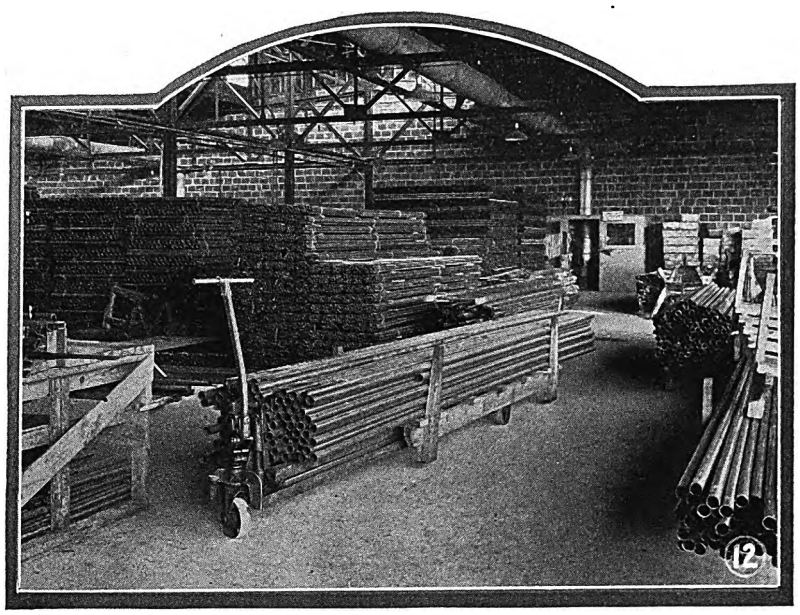


Fig. 12. Hand lift trucks are not limited to the handling of short loads. This truck is 9 feet long, and the pipe handled is about 14 feet long. The installation has proven successful under operating conditions.

ment, instead of common labor, for handling materials.

Another advantage is that, at present, common labor is not available, and the shortage is becoming more acute day by day. We first look to the southern states as a place where labor can be easily obtained, but even the industries located in such states as Alabama, Georgia, Mississippi, etc., are now turning to mechanical equipment, because it is impossible to secure the common labor to do the menial handling jobs.

Trucks that will operate with skids now fall into three classes, namely; hand operating, electrically operating and gasoline operating.

The hand truck was the first type used. Its operation is simple. It is first pushed under a loaded skid, and the handle pulled downward, (figure 19) the lifting bars raise the skid and load from the floor. When elevated, these bars assume a fixed position, and remain rigidly locked in position until they are released by the operator. To lower the load, the operator steps on the lock pedal, and releases the catch. A powerful hydraulic check eases the load smoothly and

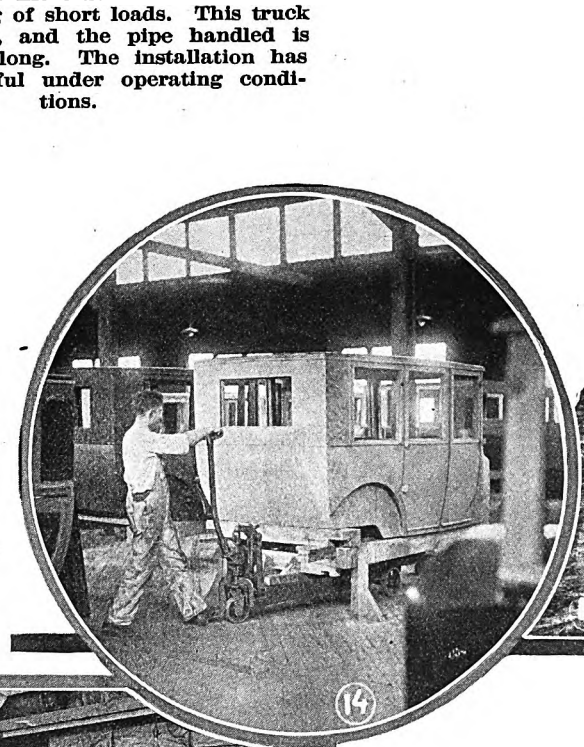


Fig. 14. Note how automobile bodies are handled by building a special wooden super-structure on the hand truck lifting bars. The bodies can be set on permanent bases, as shown, or movable bases if desired. The handling is safe and easy.



Fig. 13. While elevating hand trucks are not recommended for hauls over rough dirt roads, they are occasionally used under such conditions. This illustration also shows a cheap home-made dump body skid.

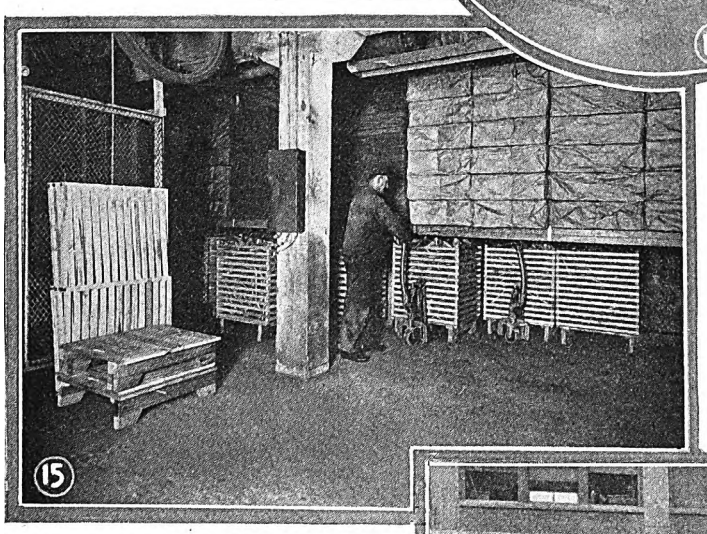


Fig. 15. This illustrates a collapsible rack for use with flat platform skids. The small parts are handled entirely in this way, and when the platforms are idle, they can be folded and put away in a small space as shown to the left.

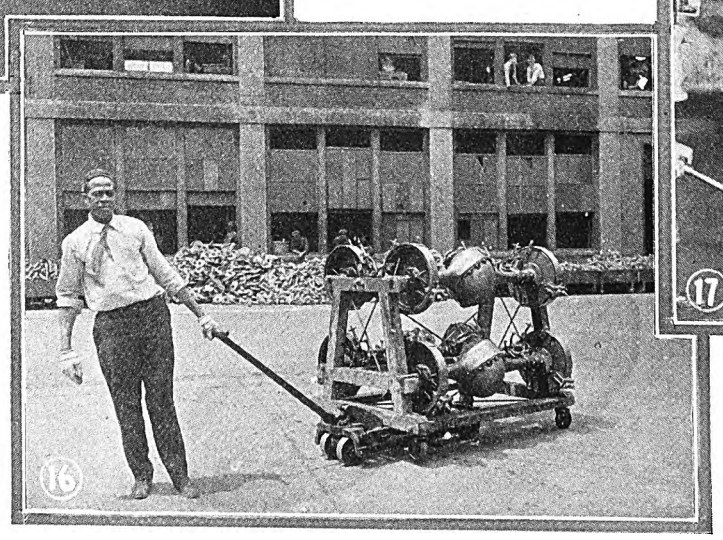


Fig. 16. Special rack live skid for handling automobile rear axles. With any other method this would be a difficult and cumbersome part to handle.

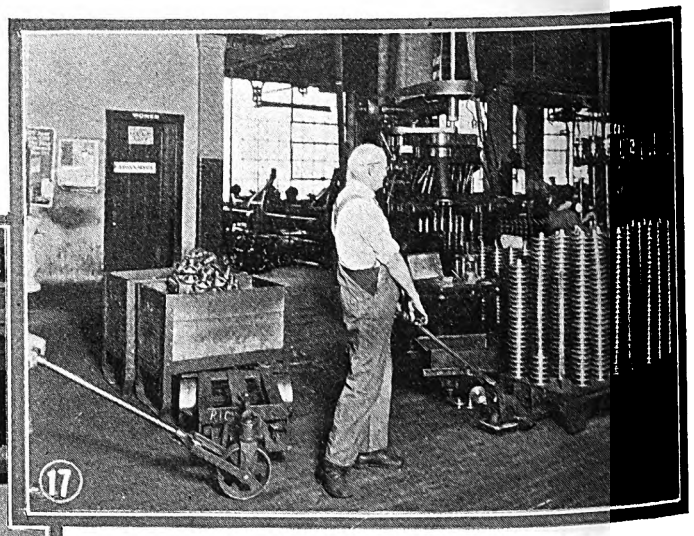


Fig. 17. Finished machine parts are easily damaged. By using skids equipped with spindles, these parts can be handled from operation to operation, and carried in stock, without being subject to damage by contact.

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evenly to the floor. The truck is then pulled out from under the skid, and can be used for another load.

The electric truck is somewhat similar in construction, but is provided with a platform on the lifting bars. This platform is elevated by means of electric power (fig. 7) and the entire load is propelled forward by means of a separate motor, the current for both motors being supplied from a storage battery which is mounted over the driving wheels. A similar truck is now being built with a gasoline motor as a power unit, the same motor operates the platform elevating mechanism. (Fig. 67)

The height of platform lift varies slightly in different makes of trucks, and this lift determines the height of the skid legs from the floor when they are being carried on the truck. If the surface on which the trucks operate is smooth, the clearance need not be so great, but when operating over rough floors, the clearance should be at the maximum, so that the legs will not catch and cause accidents.

In selecting the type of truck to be used, it is necessary to take into consideration the condition of floors, the length

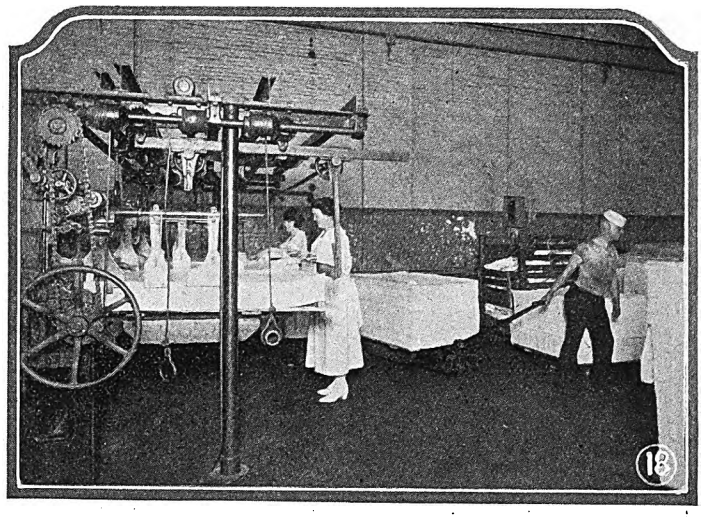


Fig. 18. The handling of paper originally brought about the development of the platform lift truck. Note how skids are supported for loading, direct from finishing machines. This illustration shows the start of the load.

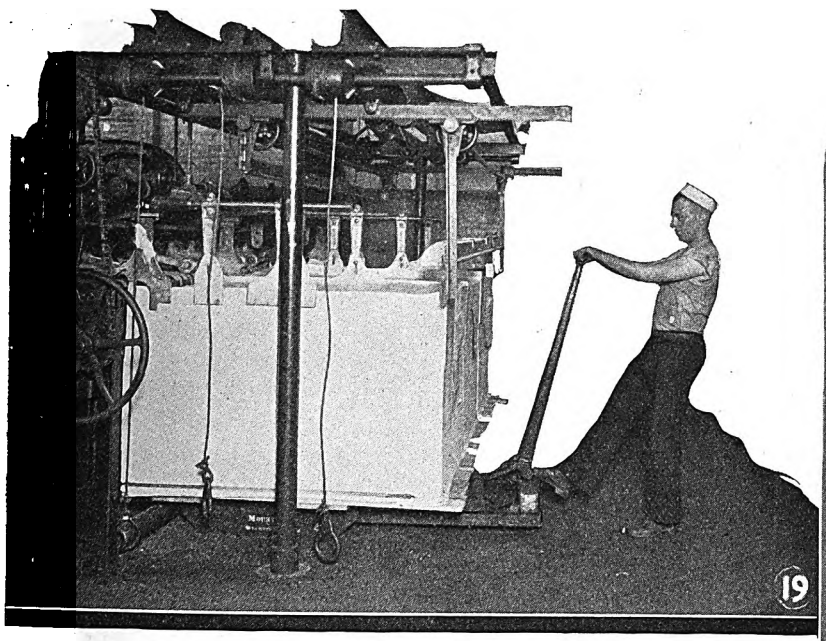


Fig. 19. This photograph was taken in the same location as the one previous, and shows skids completely loaded, and method of removing same.

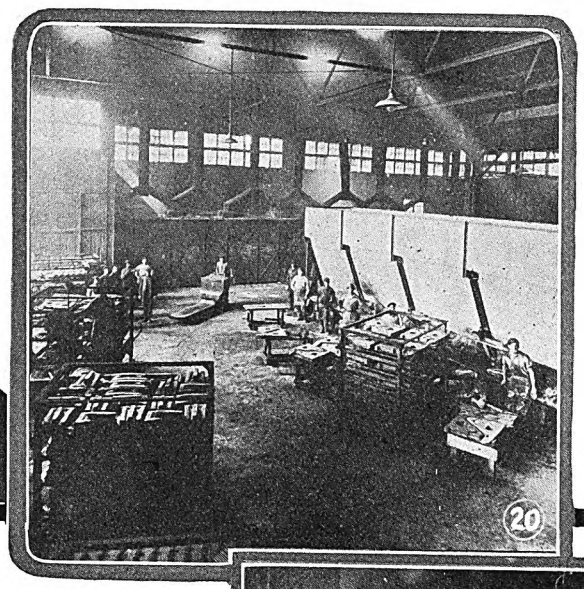


Fig. 20. Cores are fragile, and must be handled carefully. This shows skid racks being loaded direct from core-maker's bench.

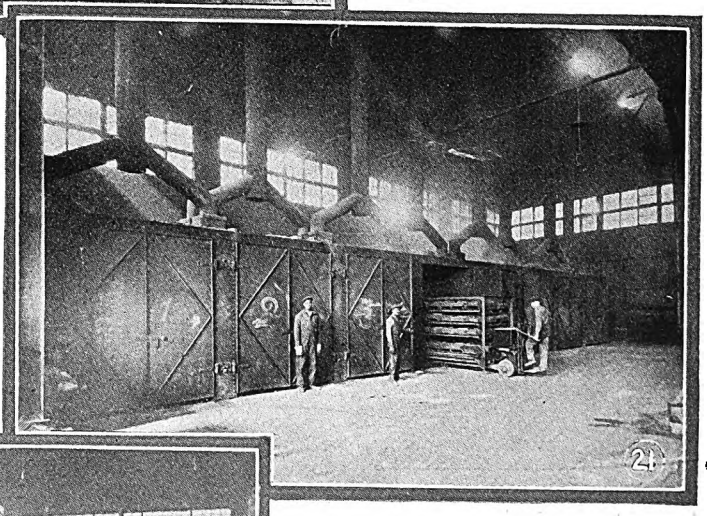


Fig. 21. This illustration, taken in the same plant as the previous one, shows the method of placing rack loaded with cores in oven.

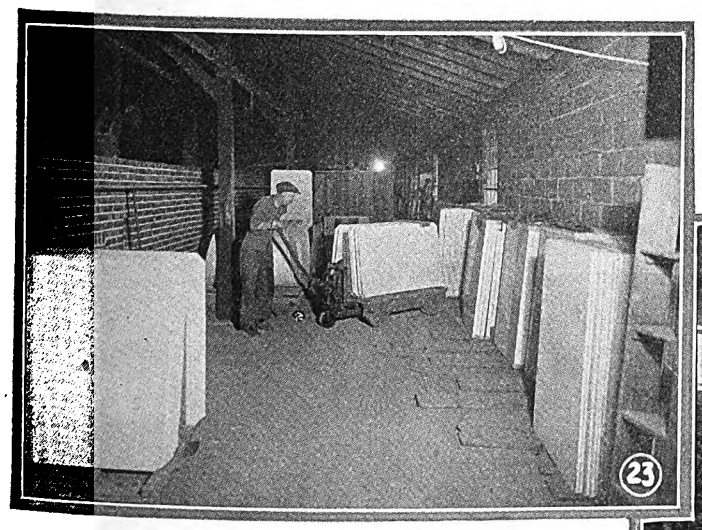


Fig. 23. Handling marble slabs without breakage is difficult, but skids and lift trucks have solved this problem. A wood rest up the center of the platform, and a simple board lock at the top, is all that is necessary. The circular slabs behind the truck operator, are handled in the same way.



Fig. 22. Close view of core rack being transported by an electric storage battery truck to foundry.

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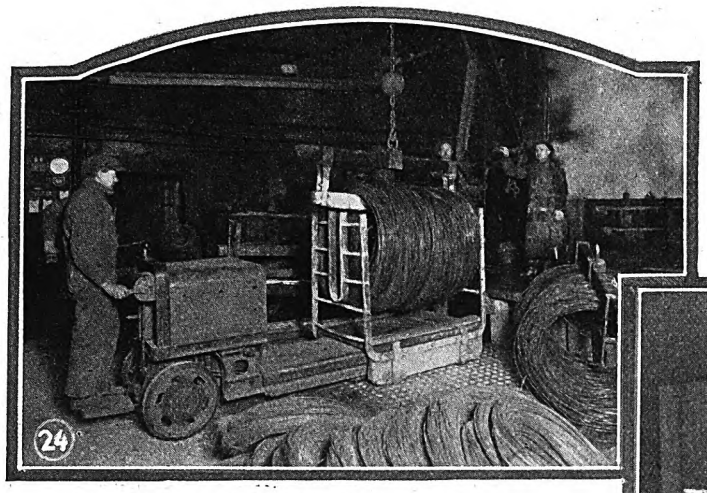


Fig. 24. To load this wire on hand trucks, and then unload it would be difficult. This special skid handles it with ease.

Fig. 25. Skids built with overhang platform operate well with standard portable elevators for piling.

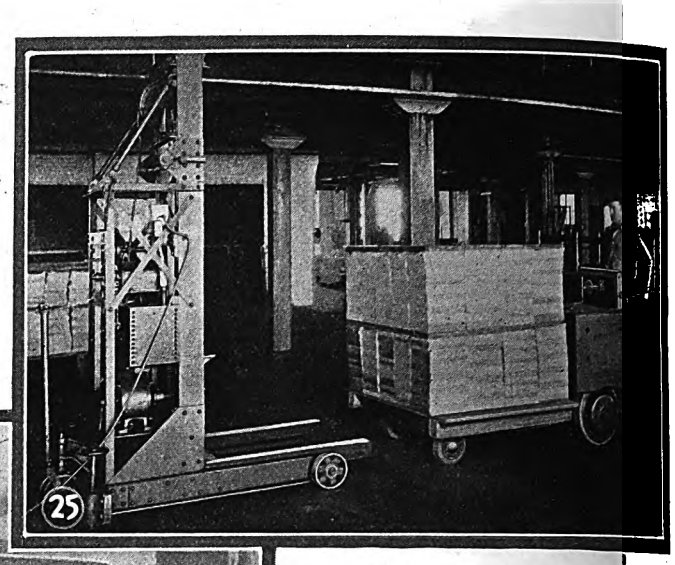


Fig. 26. Dump bodies mounted on skids have proven successful in handling refuse. The one shown is of standard design now being manufactured by several companies.





Fig. 27. The handling of small parts has caused many ingenious rack skids to be built. This shows a good method of handling and storing armatures.

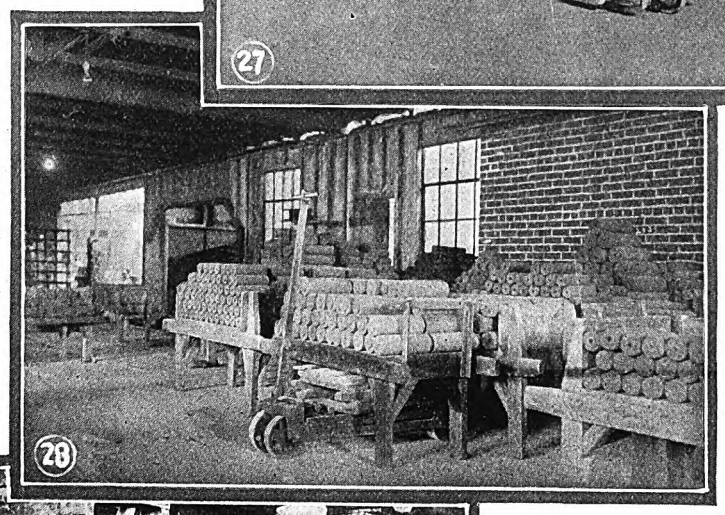


Fig. 28. These skids were originally built so that they can be carried by hand. With a simple super-structure on the truck lifting arms, it is possible to move them with one man instead of two.

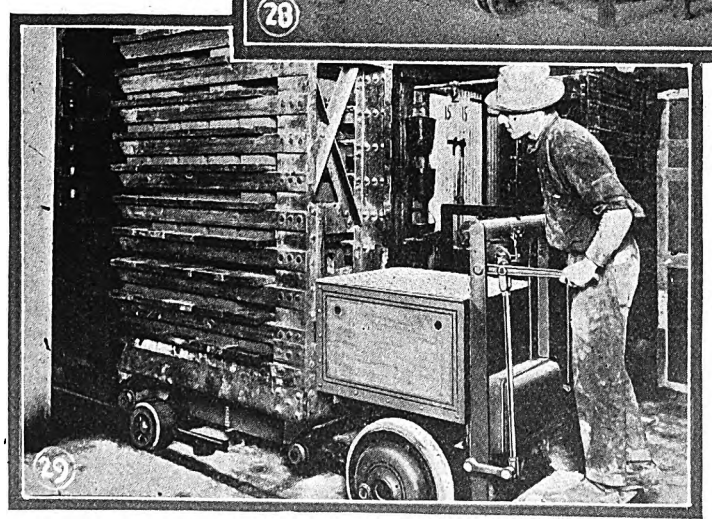


Fig. 29. The concrete block and brick industries are finding many uses for skids and lift trucks. This illustration shows 500 concrete bricks being carried directly from briquetting to bake oven, without re-handling.

of haul and the weight to be carried. The hand propelled type of truck is particularly recommended for movements or hauls up to 150 feet or less, and only over good floors. The electric or gasoline propelled truck is recommended for movements or hauls up to 3,000 feet or less, and over good floors. Although these types have been successfully operating over smooth dirt roads within the plant, they are not recommended for general yard work.

The most important part of the installation is the type of skid and particularly the construction of these skids. At first the construction consisted mainly of wooden timbers nailed together, with side legs sufficient to give the proper clearance for the truck platform. While these skids were cheap in first cost, they invariably carried a high maintenance expense, and frequently collapsed under heavy loads. Today, skids are built with wooden platforms and steel

(*Continued on page 35*)

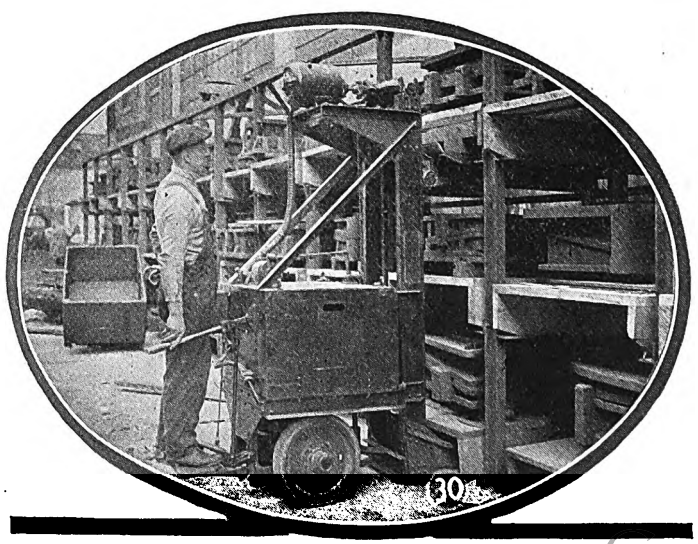


Fig. 30. The economies effected by the use of skids has brought about the use of racks, so that these skids can be tiered without resting on the load beneath. This shows a standard tiering machine placing a loaded skid in the upper tier of the rack.

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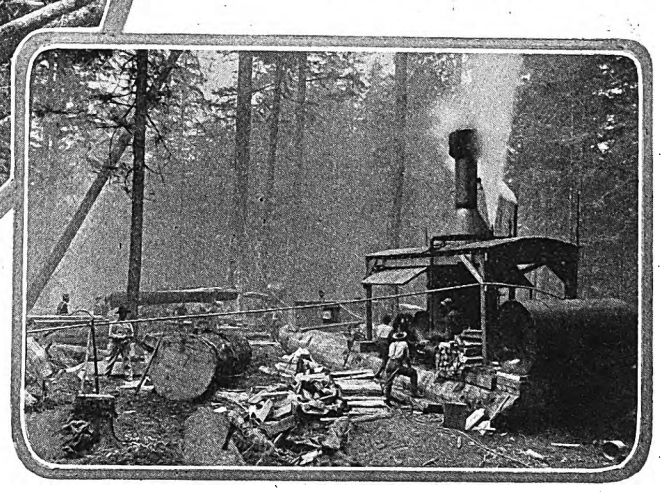
Cost Accounting in the Lumber Industry

How Coöperation Developed a Uniform System

BY O. H. KNEEN



Typical storm swept area on the Olympic Peninsula. Note the piles of fir, spruce and cedar. This is not all loss—development was expedited by the storm of 1921 and will save owners 20 years' taxes; modern methods will salvage much of this timber; the fir will lie 20 years without serious deterioration. It is interesting to note that the cedar is generally so well rooted that it withstood the wind which uprooted firs of eight centuries' growth.



Typical old time ground-skid yarder and loader, requiring too much power to plow the earth every trip and also causing a great many accidents and loss of time. It has been replaced by the high-line method.

ALMOST everyone knows that the "Evergreen State" of Washington, and its sister state, Oregon, produce one-quarter of the lumber annually cut in the United States. Only the initiated know, however, that one of the most notable examples of coöperation in the country's industrial history is also to be found in the western lumbering industry.

Near the end of the World War the lumbermen came to the brink of economic disaster. Cancelled orders, skidding prices, high wages, and a future beset with uncertainties, spelled receiverships for numbers of the less stable millmen on the Pacific Coast.

At this point came forward far-sighted operators composing the West Coast Lumbermen's Association. Early in 1918 they had started the design of a modern, practical and simple cost system, that elusive goal of all honest accountants. They aimed at a system which would be suitable for adoption, with minor adjustment, to any mill; inexpensive to operate; easily understood; yet giving the operator a clear bird's-eye-maple view, as it were, of his business.

The system was completed and a trial installation made early in 1919. So well has it filled the specifications that today over 100 mills have installed it completely, and another 150 use it as the groundwork of their accounts. It is in use in every considerable lumber-producing section of the United States, even to some extent in foreign countries. It stands as a monument to careful study and expert knowledge of lumber production.

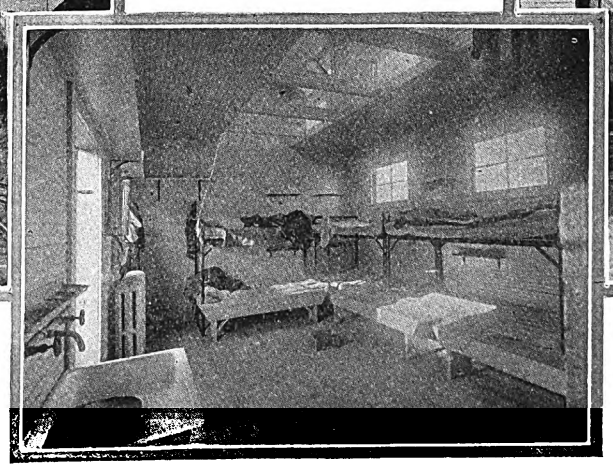
One of the most interesting

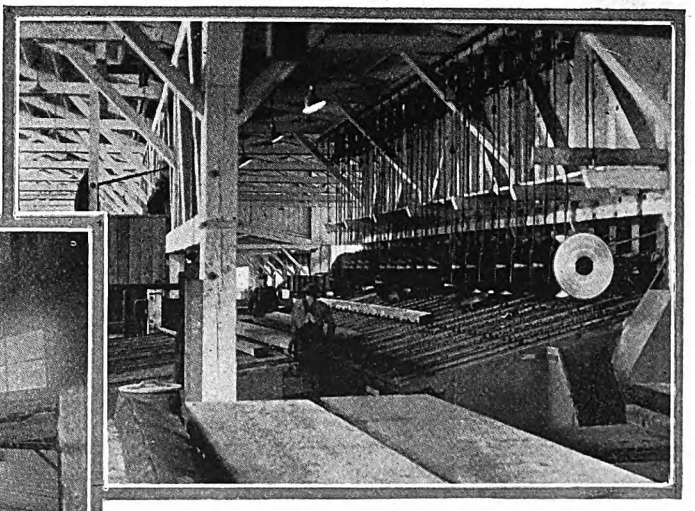
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Typical high-line methods in Washington Douglas fir logging. This method is faster, more economical, labor-saving and less liable to accident.

Logging in luxury—"Pullman" cars furnished by Snoqualmie Falls Lumber Company. The cars are 14 feet wide, 60 feet long, and have three "staterooms." At intervals the cars are thoroughly renovated by live steam.





The gang cut-off—The sawyer in the cage at the left operates each of the 26 saws by manipulating a keyboard, lowering the required saw which squares ends, cuts out knots, or cuts into shorter pieces. Saws two feet apart and will take 52-foot material.

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Personnel Work That

BY N. J.

Personnel Manager, The Paraffine



Fig. 1. The upper view shows a demonstration class in first-aid learning by actual illustration the proper method of applying bandages.

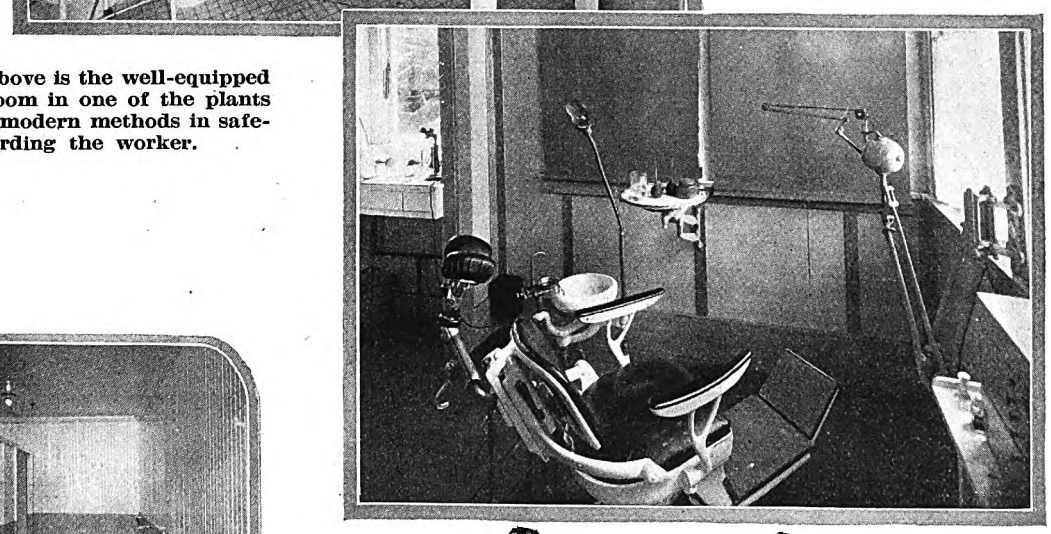
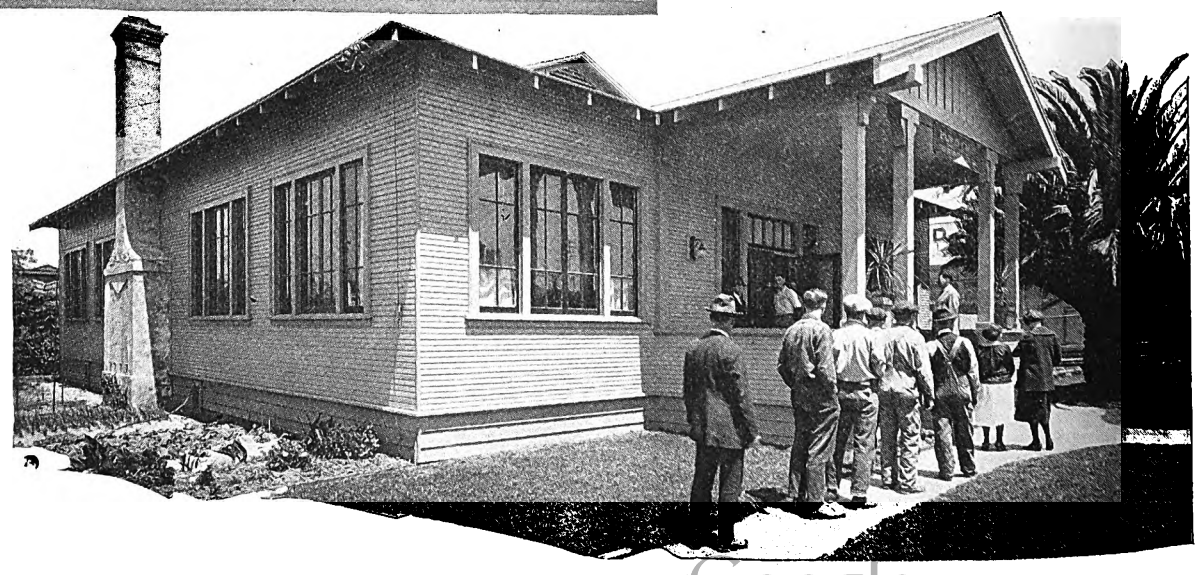


Fig. 2. Above is the well-equipped first-aid room in one of the plants typical of modern methods in safeguarding the worker.



Fig. 4. Dressing rooms, with wash-basins having hot and cold water, are an appreciated convenience.

Fig. 5. The club-house at the Emeryville plant; with a group on their way to lunch.



THE Paraffine Companies, Inc. derives its name from the Paraffine Paint Company—an organization founded over forty years ago to manufacture black (asphalt base) paints. With the development of business the company added new products to its line, such as felt-base roofings, felt-base floor covering, house paints, etc.

In 1917 The Paraffine Paint Company had grown so large and was making such a diversified line of products that a consolidation of numerous interests was effected, and today the firm, now known as the Paraffine Companies Inc., operates sixteen plants on the Pacific Coast making the following products:—Roofings, floor coverings, house paints and enamels, building paper, sheathing, paper boxboard and wallboard, solid and corrugated fibre containers and shipping cases and cartons of every description.

It has always been the desire of the management to practice enlightened human relationship with its workers. Close and friendly contact has always been maintained, but expansion, with this company as with others, has had the effect of making this contact more and more difficult. Realizing this growing condition and the necessity of correcting it along the more progressive scientific lines, a local man-

Fig. 3. At the left—Dentistry plays a very important part in general health; as we have only recently come to recognize.

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Pays Dividends

RICH

Companies, Inc., San Francisco, Cal.

agement research bureau was called in to make a labor audit and survey of one of the plants. It is upon the basis of this survey that the department of personnel was established in 1920 at which time there were some four hundred employees in the plant investigated.

The scope of the work now includes those features usually found in the personnel department of large eastern organizations, namely:

1. *Employment*:—The centralization of placement, transfer, promotion and discharge covering the plants of the central group, i. e., those situated in the San Francisco Bay District. Contact with the plants outside this group is maintained in a spirit of general coördination.

2. *Medical and Health Service and Education*:—The examination of all applicants before acceptance and subsequent periodic re-examination. This has effected a noticeable reduction of accident rates.

A dental service has been established for the employees. The cost of this feature is carried jointly by the company and the individual employees treated. Treatments are made on company time thereby effecting a big mutual saving.

Home visiting is carried on by a nurse in conjunction with

(*Continued on page 53*)

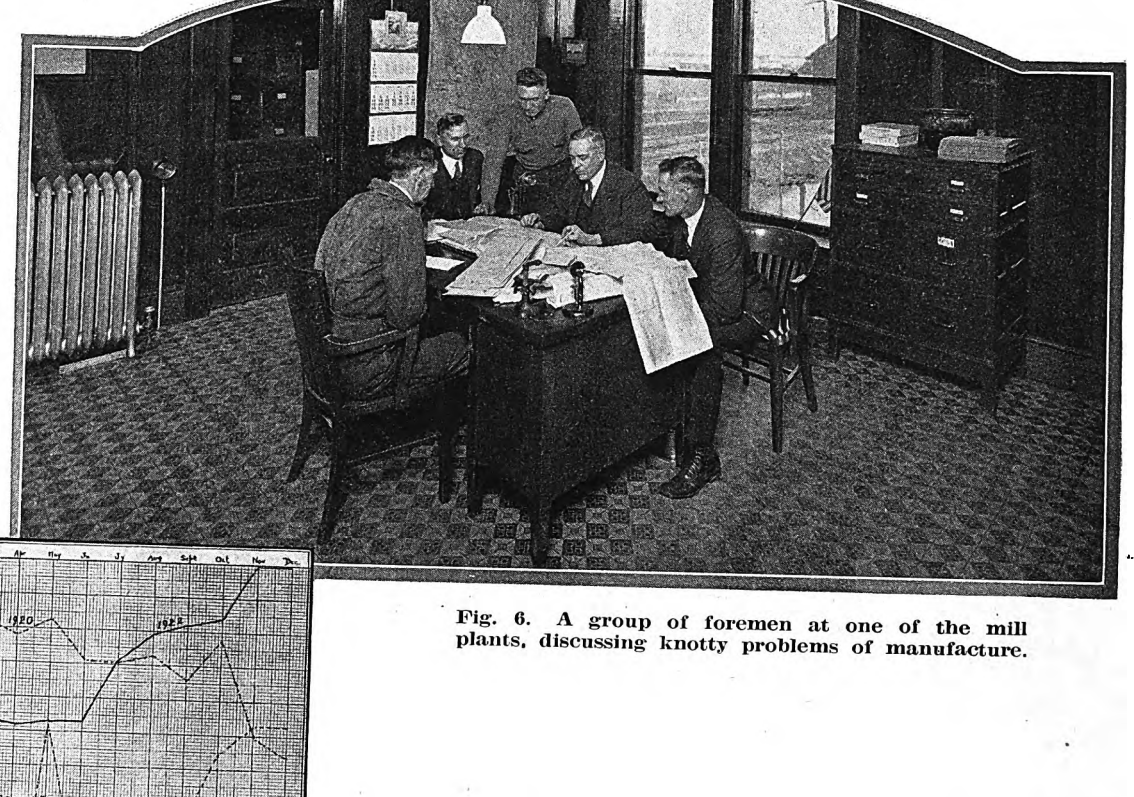


Fig. 6. A group of foremen at one of the mill plants, discussing knotty problems of manufacture.

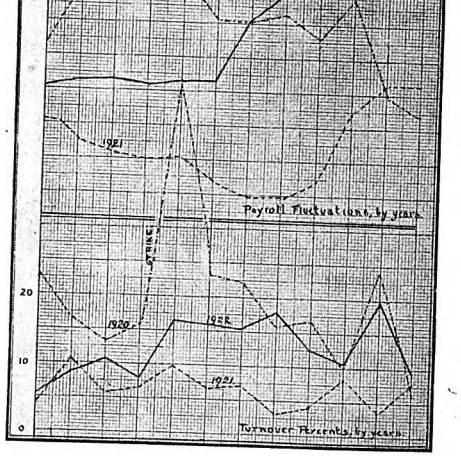


Fig. 7. A composite chart of labor turnover and number of employees for the years 1920, 1921 and 1922, in one of the central-group plants.

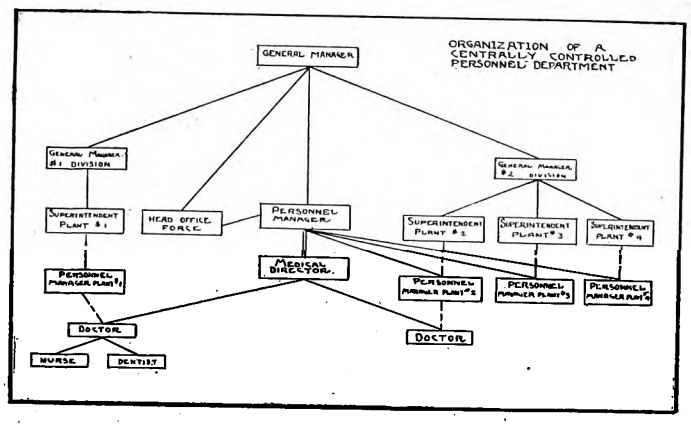


Fig. 8. A Chart of Organization of the centrally controlled personnel department which functions in all the plants.



Fig. 9. A regular meal is served daily —not cafeteria fashion—at the plants, and both quality and reasonable cost make this an important part of the work.

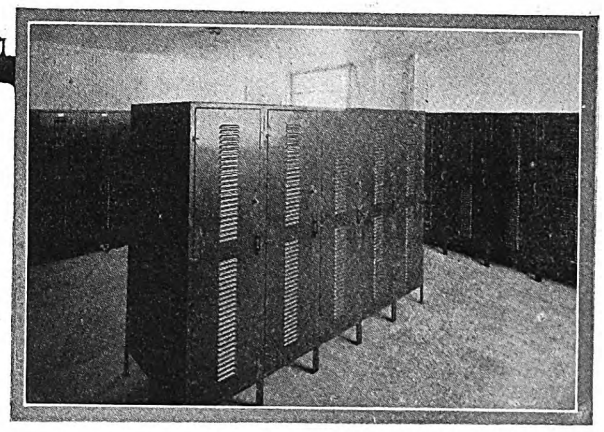


Fig. 10. Individual lockers are furnished, and sanitary conditions have had much to do with keeping up the morale and lessening turnover.

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Solving the "Impossible"

Special Equipment for Difficult Transportation Problems

By William Greaves

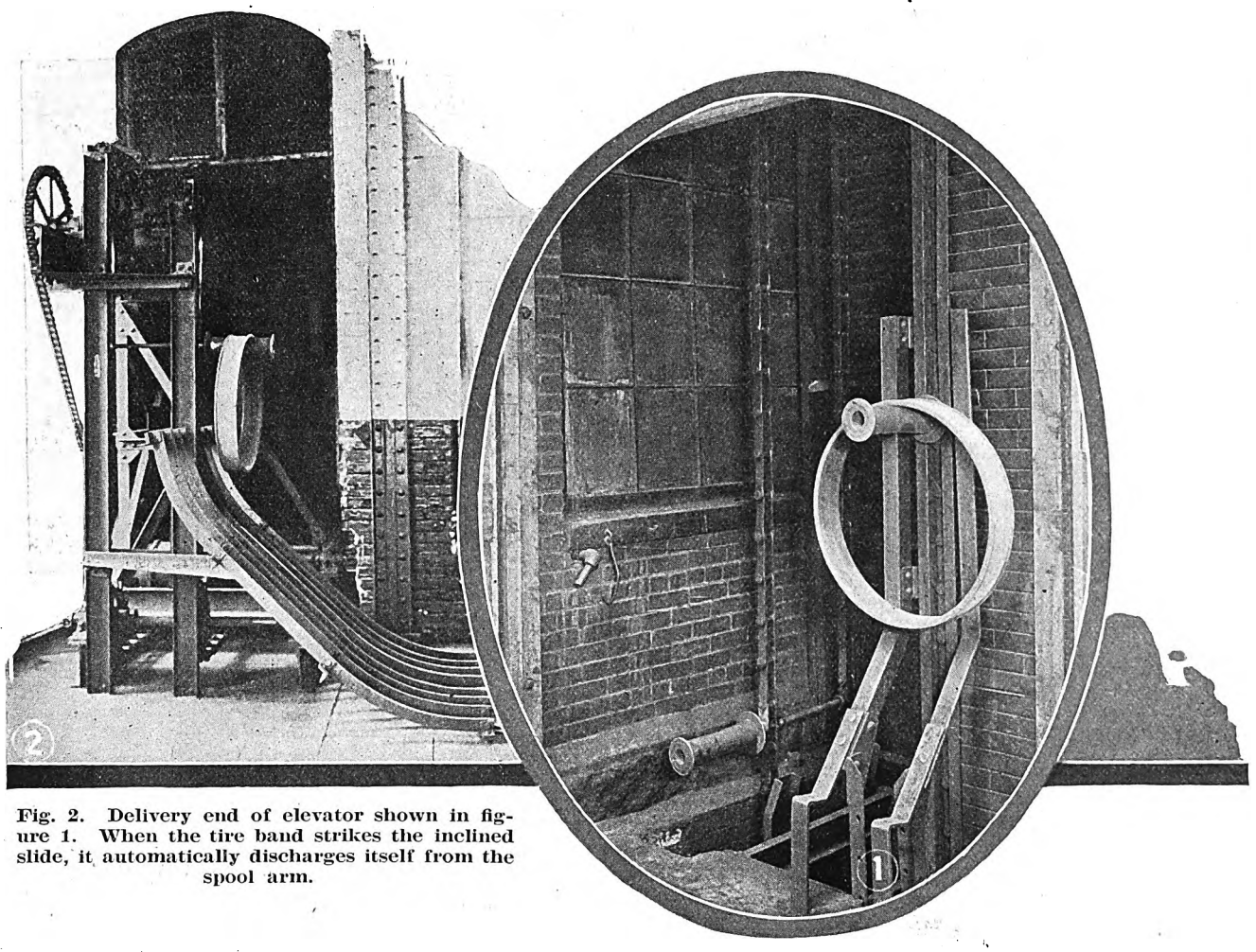


Fig. 2. Delivery end of elevator shown in figure 1. When the tire band strikes the inclined slide, it automatically discharges itself from the spool arm.

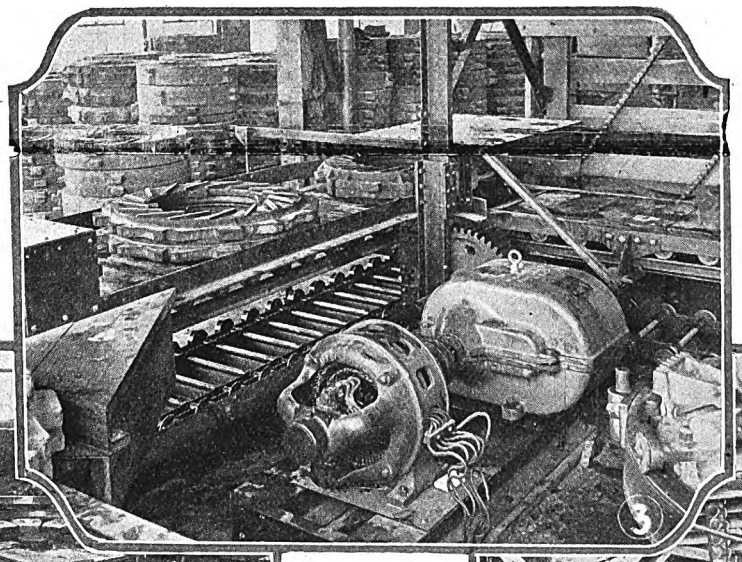
Fig. 1. Illustrating method of carrying band, and the ease with which same is loaded on spool arm.

QUITE frequently the handling of certain classes of materials mechanically, is considered impossible, because the manufacturers' catalogues do not show, and their representatives do not know of the many ingenious devices that have been made up from standard parts, and which are now successfully performing mechanically, operations that have always been considered as necessary evils to be performed by hand labor.

Many of these devices are considered as trade secrets by plant executives, and are closely guarded, so that other plants cannot use them as a means of reducing their production costs. Because it is so simple to buy standard sprockets, chains and attachments, it is not difficult for the engineering department of a plant to design and build conveyors to fit their particular requirements. While we cannot entirely condemn the attitude of plant executives in keeping the design of this equipment secret, we do feel however, that they would gain a number of new suggestions, and would do much to promote the particular industry in which they are interested if they would more fully describe the design and operation of

Fig. 3. Special, extra-heavy channel iron platform conveyors, handling tire moulds in rubber plant; showing method of transferring from one conveyor to another, at right angles, also layout of drive.

Fig. 4. Continuous single run horizontal platform conveyor showing method of drive, and how platform sections are bevelled to permit turning right angle corners.



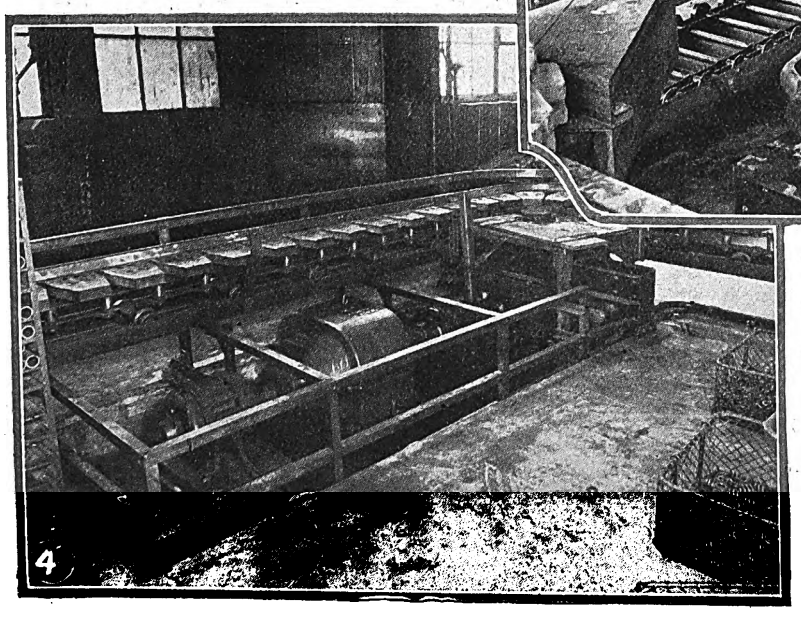
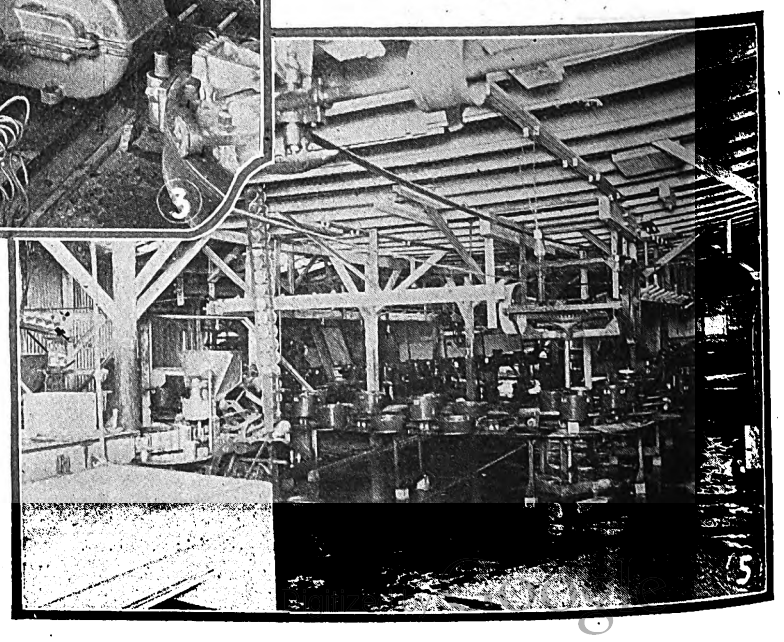


Fig. 5. Continuous peeling table in modern cannery. A machine designed for the particular needs of this industry.



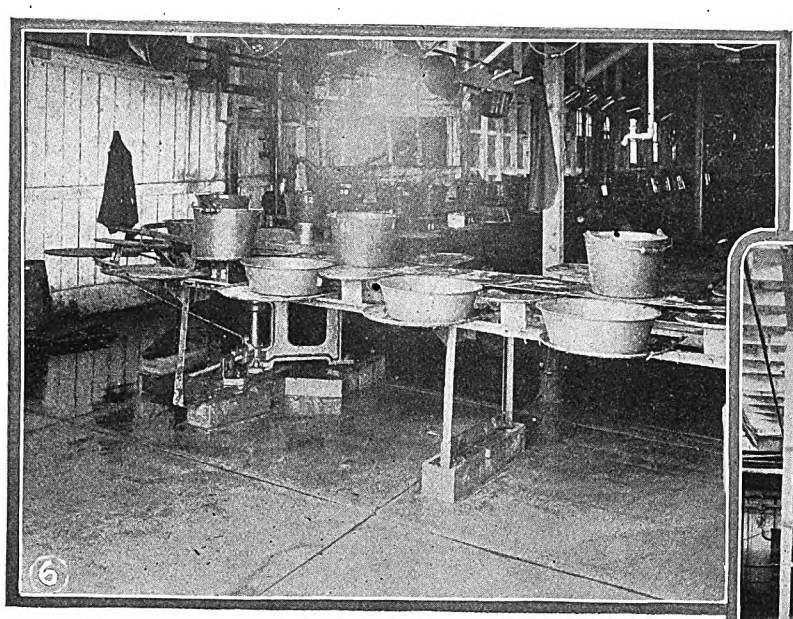


Fig. 6. Close view of continuous peeling table, showing bracket supports for buckets and pans. This class of quipment makes for sanitary conditions, increases production, and saves space.

their special equipment, and any detail as to what savings have been effected by this installation.

The use of mechanical equipment for handling all classes of materials does not only provide a remedy for overcoming the present labor shortage, but it eventually will have direct reaction upon reduced prices, and reduced prices benefit all, from the laboring man to the banker, provided the profits are not cut in order to bring about this reduction. If we reduce the cost of production, we can reduce the prices without cutting profits, and that is what materials handling equipment does.

To show what we mean by special device, we will look at figures 1 and 2, which show the method of loading and unloading an elevator for tire bands at the plant of the Revere Rubber Company, Providence, R. I. The elevator is located outside the building, and has at the top a short horizontal run to carry the bands into the building at an upper floor. The bands are placed on the bracket to the right, at ground level, and are picked up by the spools shown in figure 1, are elevated vertically and automatically delivered on to unloading skids at the end of

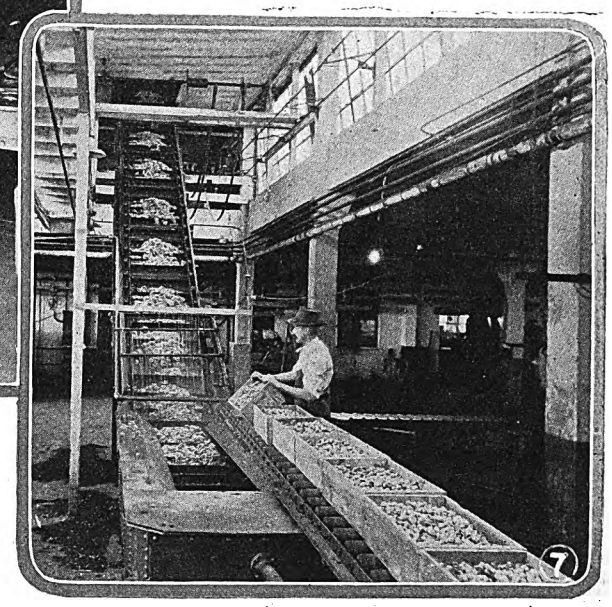


Fig. 7. A steel apron conveyor built in as a part of the washing operation in a grape juice plant. The conveyor not only handles the grapes through the washer, but it elevates them into the factory.

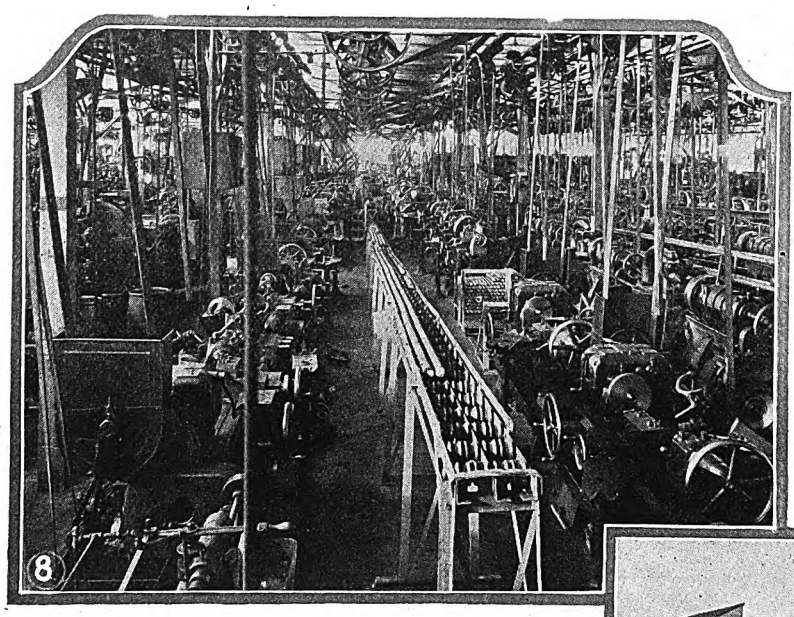


Fig. 8. Special gravity conveyor with concave rollers, handling steel shafting between machine operations. By changing the design of the conveyor rollers, various odd-shaped materials can be handled by means of gravity.

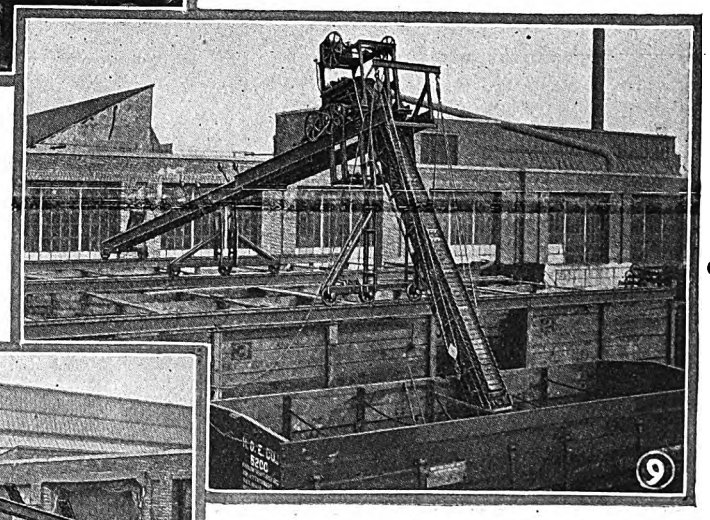


Fig. 9. Special combination slat elevator conveyor and gravity roller conveyor machine for handling pig iron from cars to storage bins.

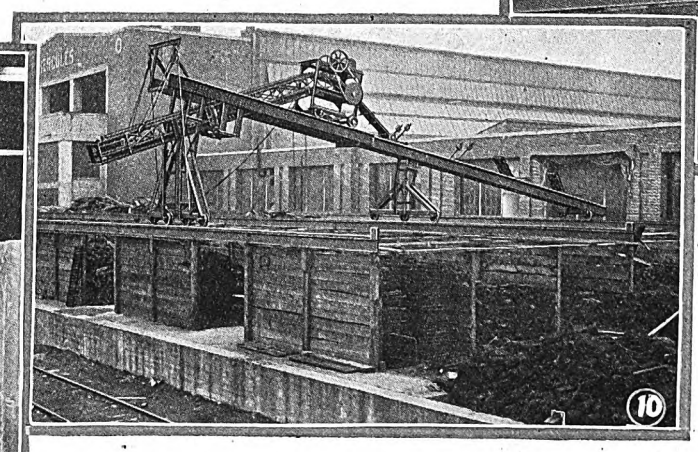


Fig. 10. The same machine as figure 9, with elevator unit hoisted to permit passage of cars on railroad tracks.

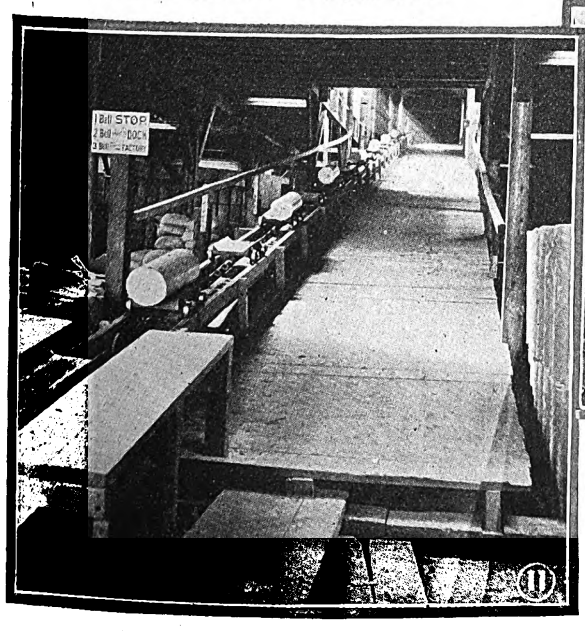


Fig. 11. Special dolley conveyor handling 300-pound rolls of roofing paper between factory and dock, at the rate of 300 rolls per hour.

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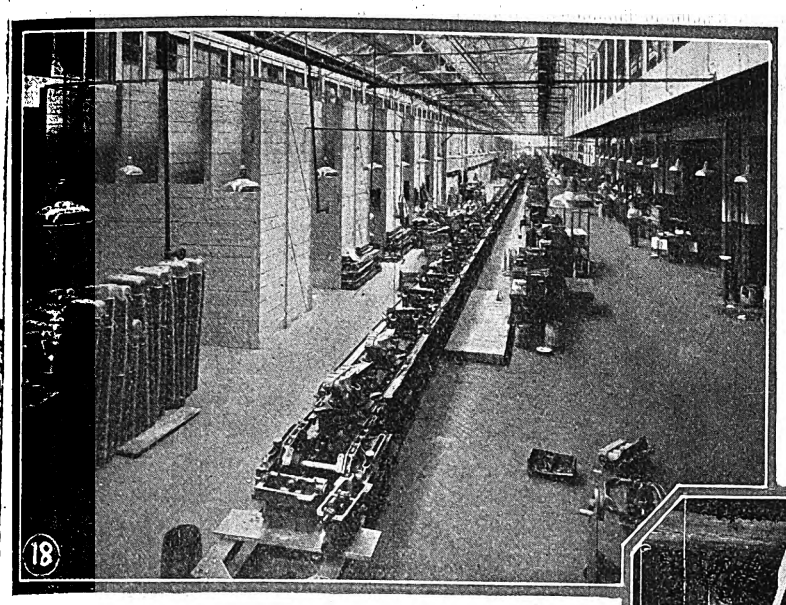


Fig. 18. Special revolving turn table platform conveyor for handling automobile engines on progressive assembly operations. This conveyor saves considerable non-productive labor expense and valuable floor space.

the method of driving these conveyors. In this case, separate runs of conveyor are used, and the moulds are fed from one conveyor to another at the corners, being guided by means of angle guard rails. This illustration also shows on the bottom run of the conveyor, the special construction of a heavy channel iron platform conveyor. It will be noted that the platform is made up of standard channel iron section, and the chain is special, being connected together by means of heavy rod, upon the ends of which are large rollers, running on tracks which carry the load. This equipment is of extra heavy construction, and is therefore necessarily a special design machine.

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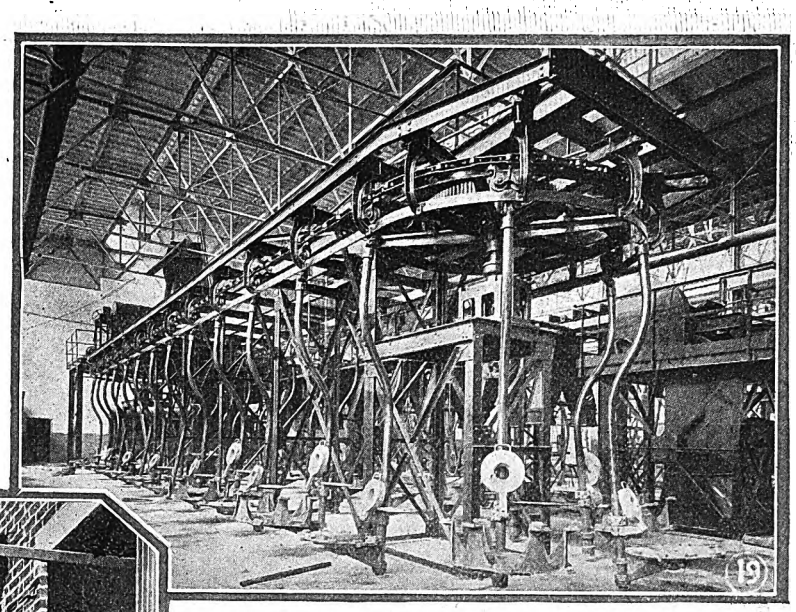


Fig. 19. Precedent governed the foundry industry until it was necessary to give quantity production. When the production needs called for it, conveyors solved the problem, and saved money and space. This is a special continuous mould conveyor.

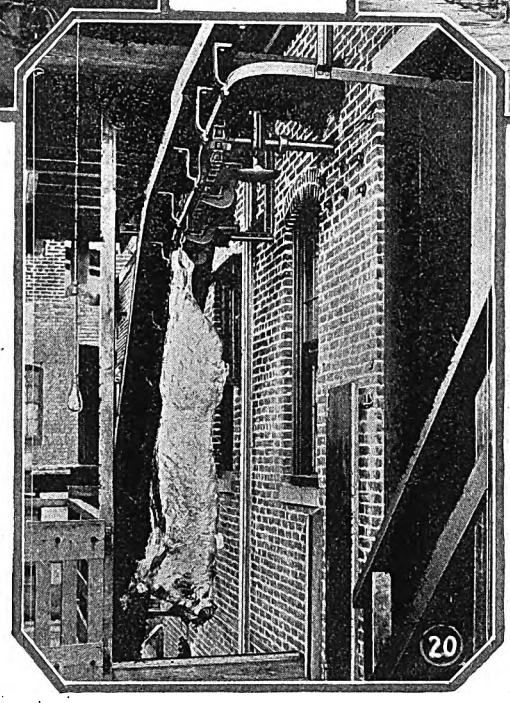
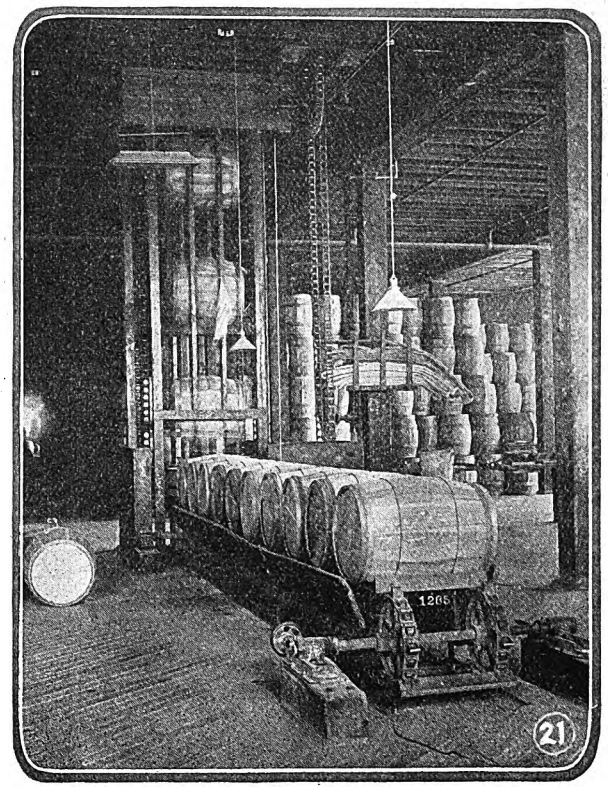


Fig. 20. The packing industries use miles of overhead trolley conveyors. This shows a chain with attachments, which operates as an aid on the inclined uphaul for elevating sides of beef.

Fig. 21. Special feeding conveyors are as essential as the other equipment. This shows a special conveyor for automatically feeding vertical arm elevators.



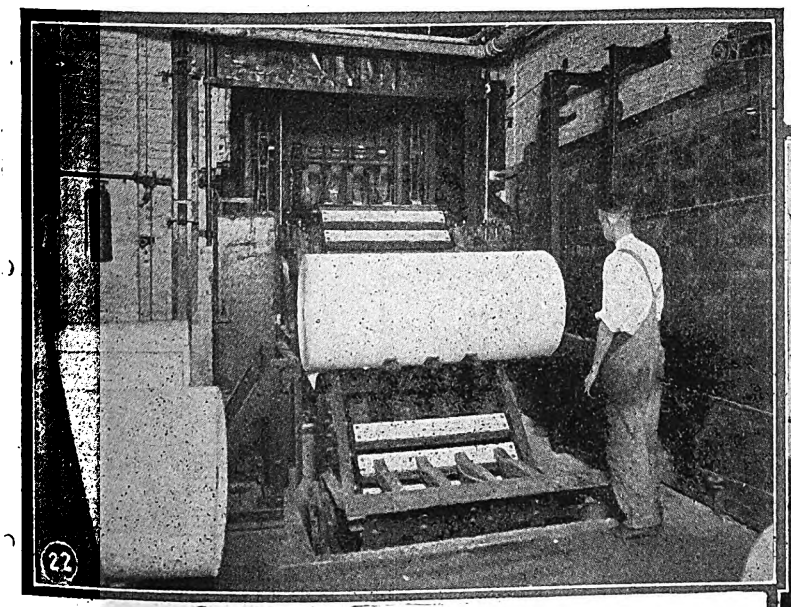
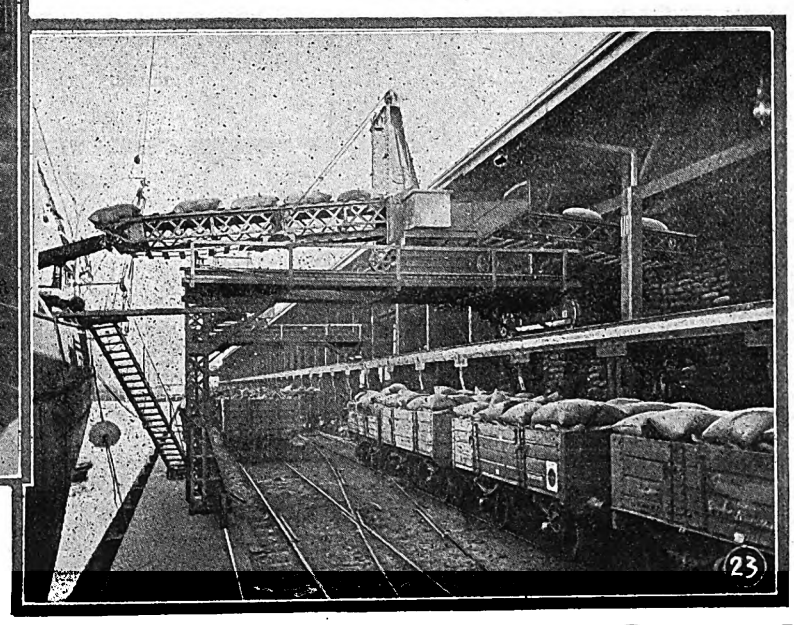


Fig. 22. When feeding heavy rolls of paper to vertical arm elevators, it is necessary to feed them at just the proper time. The device shown insures automatic loading to the elevator.

Fig. 23. Special American-made equipment is also operating in foreign countries. This conveyor loading vessels in a port in Australia is of American design.



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Cutting the Excess Cost of Coal

Equipment that Shortens the Road from Mine to Boiler House

BY JAMES T. BEARD, 2nd

THERE are many reasons why the problem of handling coal in the average industrial power plant has attracted the thoughtful consideration of managers, superintendents and engineers, but perhaps the most potent of these are the increasing cost, unreliability and wastefulness of hand labor today. If our power plants could be transported by some magic "presto" to faraway lands where a day's labor can be bought for a few yens or a handful of kopecks, we would be troubled very little by the fuel-handling question. But the present-day conditions in the labor market of this country make the cost and methods of transferring coal from the cars to the boiler house a very important and substantial item of the operating cost and dependability of the plant.

Large industrial plants are usually located on a railorad spur or at the water front, to minimize the cost of handling the finished product and the raw materials, including coal. In such stations the large quantities of coal handled daily often warrant elaborate conveyor systems that would not be justified in smaller plants.

Many industrial plants, however, are located in the midst of cities, where switching facilities are not available and where coal must be handled as it comes from the 5 or 10-ton trucks.

No matter what system is provided for handling the coal at the plant, it must include adequate allowance for storage. The quantity of coal in this reserve must, naturally, be sufficient to operate the plant during periods of interrupted delivery, strikes, etc. In small plants these storage bins may be located within the building itself. Ordinarily it

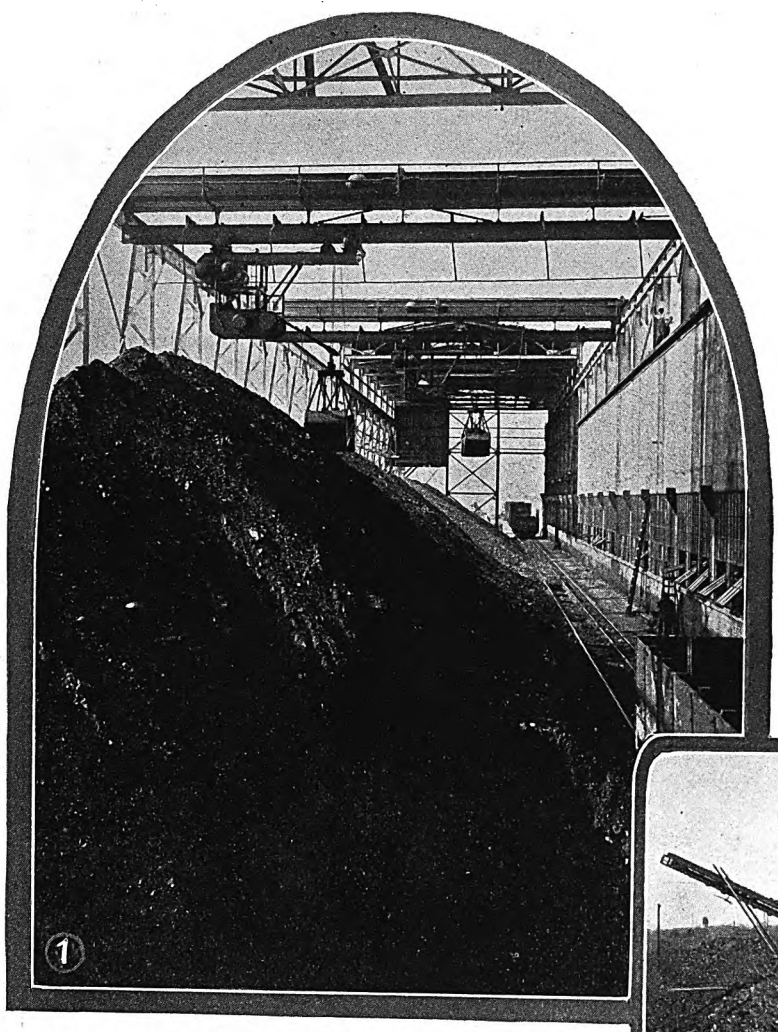


Fig. 1. Electric hoist and grab bucket, operating on a transfer crane, unload cars as they are shifted to boiler house siding. The coal may be deposited on the storage pile at the side, or if the bunker supply is low, the hoist and load is run from the crane onto a monorail track directly into the boiler house.

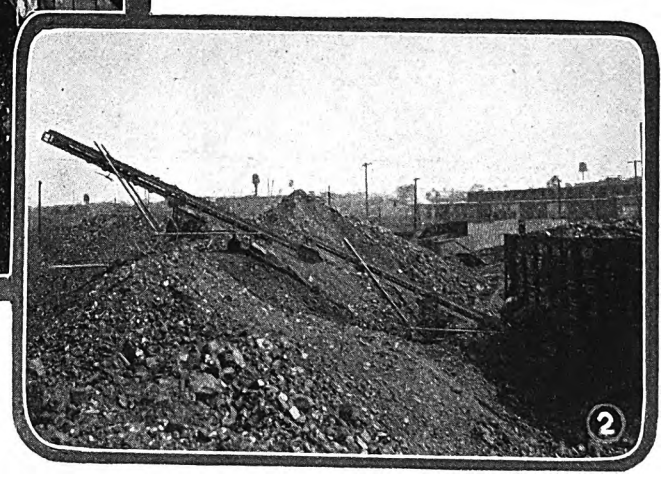


Fig. 2. Portable loaders and unloaders afford inexpensive and flexible means of solving the coal handling and labor problems in many plants. Two unloaders are shown here operating in series to unload the coal from the railroad car to the storage pile.

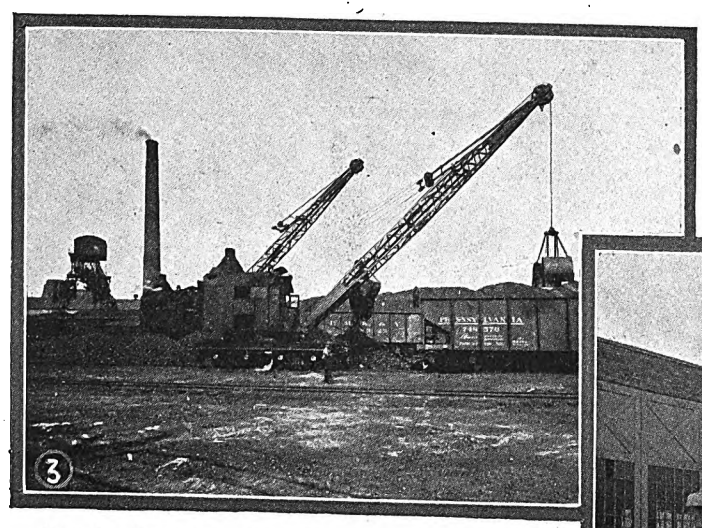


Fig. 3. In large plants where several cars of coal are handled in a day it is certainly economical to use a locomotive crane for loading onto the storage pile. The equipment shown here is of the steam-driven type.



Fig. 4. In smaller plants a gasoline-driven tractor type of crane does the work of many men. When not used in feeding the storage pile, it has many other uses which make it a profitable investment.

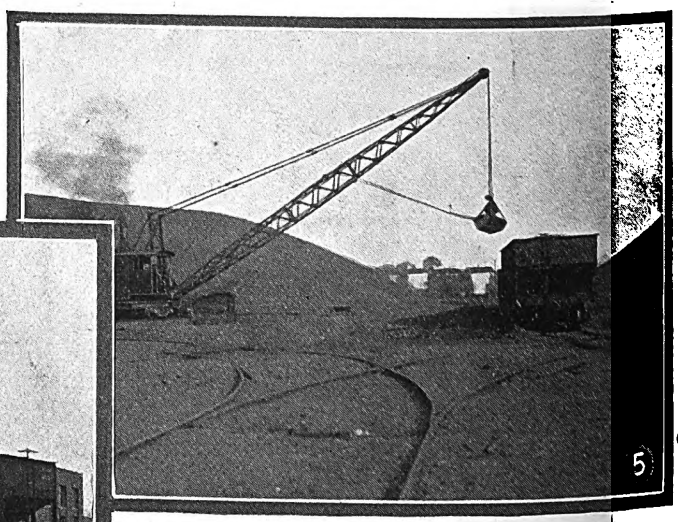


Fig. 5. Locomotive cranes with long boom spans assure rapid unloading and are particularly adapted to stocking up large storage piles. Considerable work can be accomplished from a single position.

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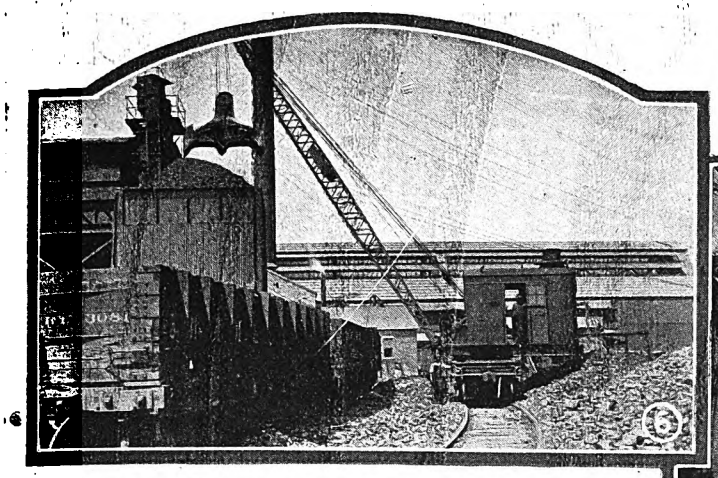


Fig. 6. Where no trestle is provided for in the design of the coal handling system, the locomotive crane performs a valuable service in transferring the coal from the cars into an overhead hopper, whence it drops into suitable crushers below.

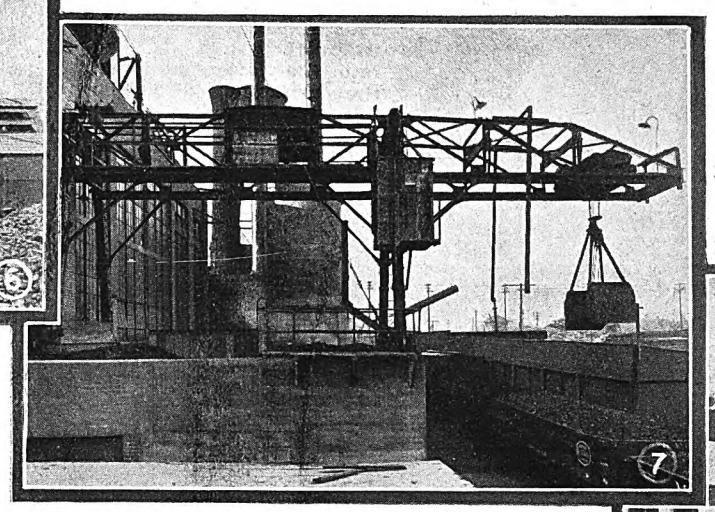


Fig. 7. An electric gantry crane with cantilever span gives a simple solution to what is often a difficult coal handling problem otherwise. The equipment in the picture shows how coal is transferred from cars on the siding into the hopper above the crushers.

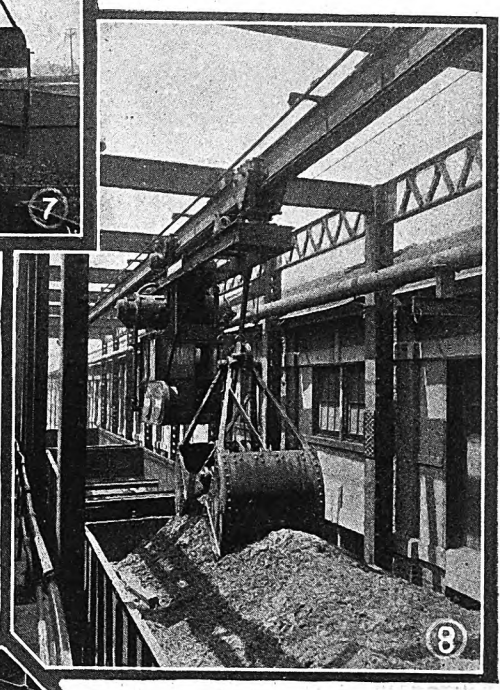


Fig. 9. This particular electric hoisting crane is designed to handle ashes and eliminate the wheelbarrow method of getting them out of the boiler house. The drudgery and cost with the use of the latter system is absent here.

is a good plan to carry a four or five days' supply within the plant and, in view of the experiences of the past few years, it is certainly advisable to provide outside space for a much larger reserve, depending upon the size of the plant.

Where plants are located upon a railroad siding the unloading problem is usually very simple. If a spur can be run alongside the boiler house, drop-bottom cars can be emptied quickly into a hopper beneath the tracks, discharging from there into a roll crusher. But the supply of drop-bottom cars cannot always be depended upon and provision must also be made for unloading by means of a grab bucket. Unloading from cars to the reserve pile in the yard is done by a locomotive crane.

Clam-shell drop buckets are suitable for unloading barges, if the plant is located on the waterfront.

In the storing of coal, both in the yards and in bunkers, many difficulties are often experienced with certain grades of fuel. Spantaneous combustion is sometimes a serious factor to be contended with, par-

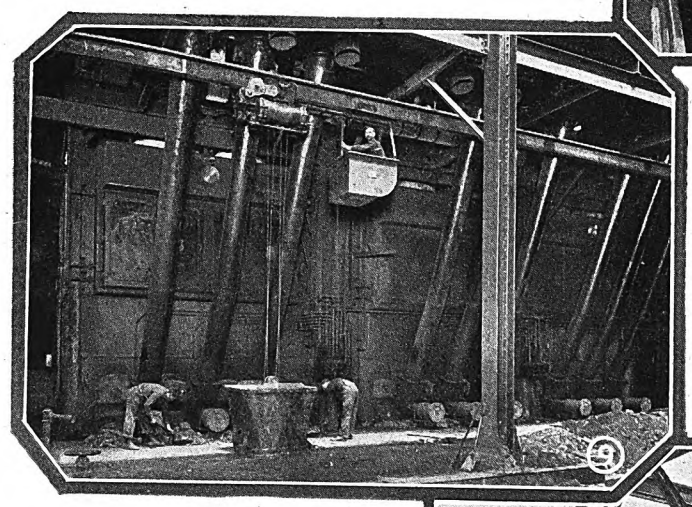


Fig. 8. With the type of electric crane hoist shown here it is not only possible to unload coal from the cars into the boiler house, but to remove ashes and load them into empties as well.

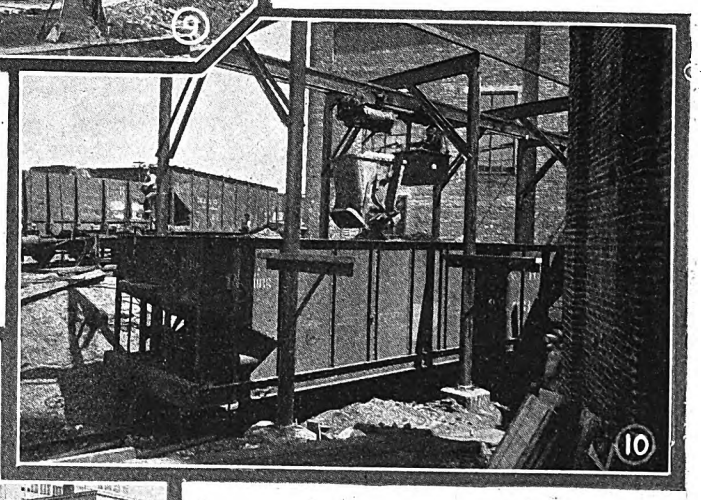


Fig. 10. Traveling out of the boiler room door along an overhead track, the electric ash hoist carries ashes to any desired point and may deposit them either on the dump or in railroad cars to be hauled away.

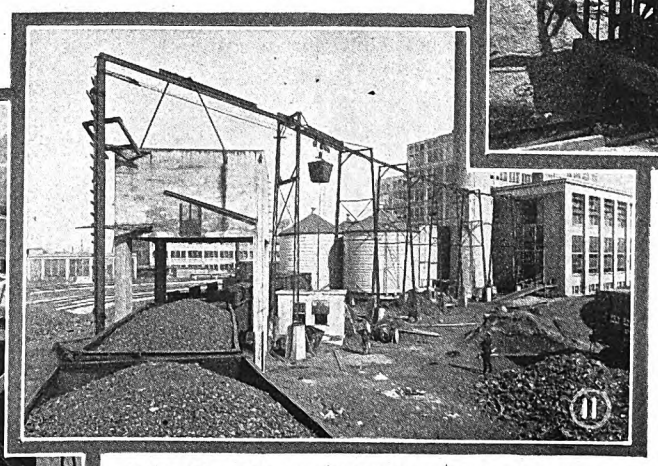


Fig. 11. Another combined coal and ash handling system that is characterized by its simplicity, low first cost and ease of operation. Coal is unloaded from the cars into the bunkers and ashes are in turn dumped into the concrete ash bin.

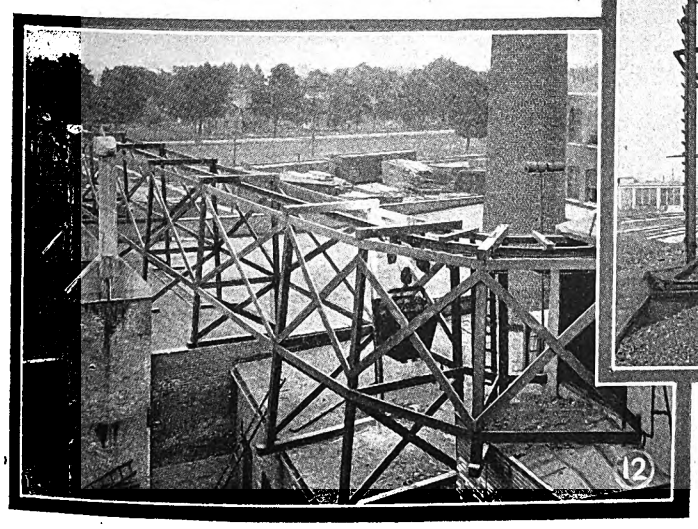


Fig. 12. When the boiler house is located in a spot not conveniently reached by the railroad siding, an overhead track similar to the one shown here solves the problem in a simple and economical way.

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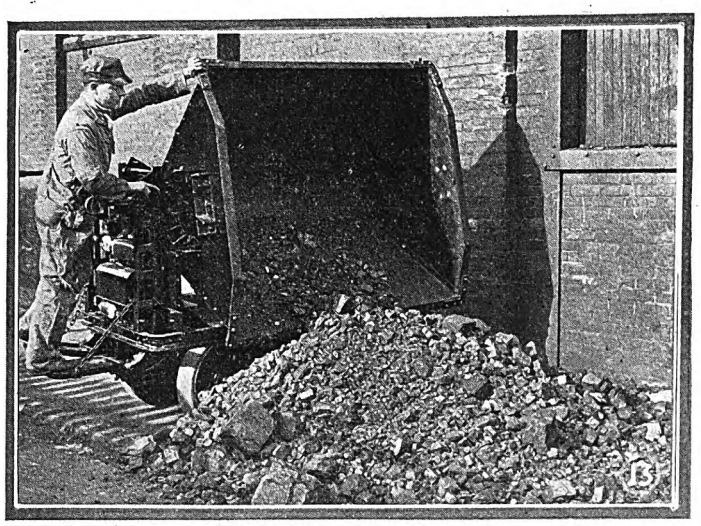


Fig. 13. Beats the wheelbarrow all hollow! Here's an inexpensive and efficient way of getting the coal from the storage pile into the boiler house and is often the only solution left if other methods are fund impractical.

ticularly when there is a large content of iron pyrites. Once a storage pile has caught fire it is usually a very difficult matter to extinguish it and involves turning the pile over, which is an expensive proposition at best.

Spontaneous combustion occurs because the heat produced by the slow oxidation of the coal is not carried away by adequate ventilation. The temperature, consequently, increases until the coal itself ignites.

In storing coal that is subject to spontaneous combustion it is usually desirable to divide it into small piles, rather than lump it into one big mass. Iron pipe, capped at the bottom, should be inserted into these piles so that temperature readings can be taken to indicate the presence of fire in the pile and to forestall a temperature condition that would

(*Continued on page 57*)

Fig. 15. How the skip hoist actually looks. The frame work in the foreground carries the tracks almost vertically up the side of the boiler house, where they suddenly turn into the tower, allowing the carriage to discharge into the bunkers. In the background is a similar hoist for handling ashes.

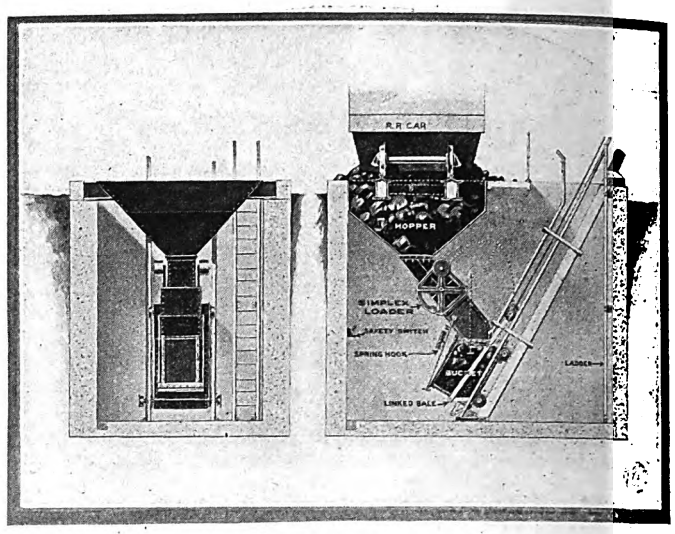


Fig. 14. Another successful solution of the high cost of ash handling is the skip hoist, consisting of a carriage hauled at high speed up a very steep incline and discharging its load at the top into suitable bins. This system is successfully used in many plants for handling both coal and ashes.

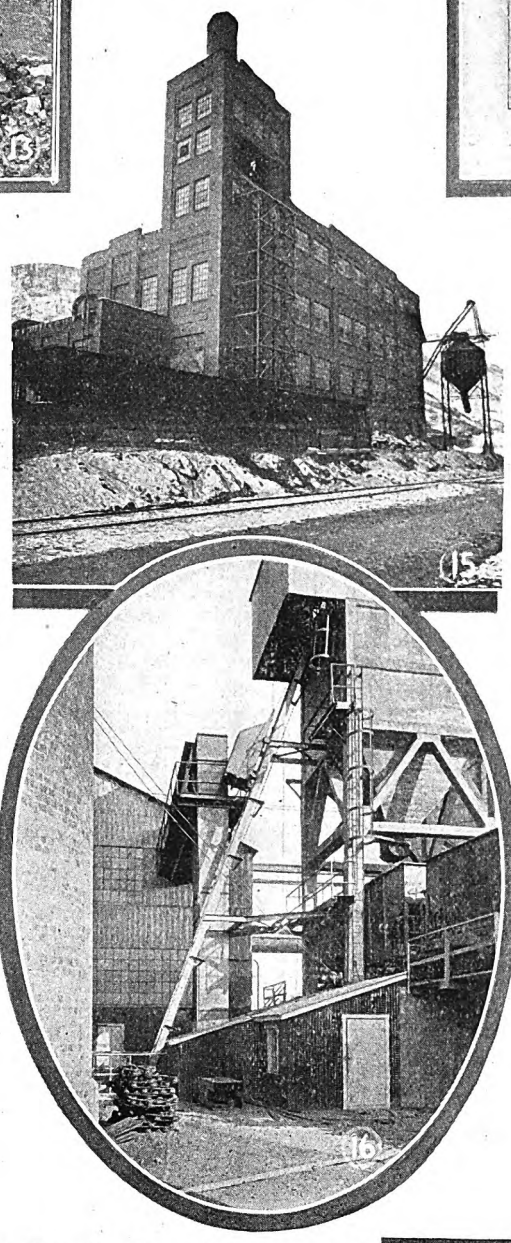
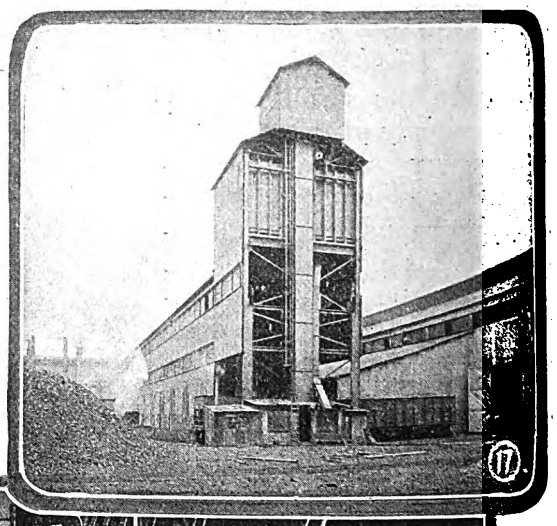


Fig. 16. Another view of a skip hoist showing the carriage half way up the steep incline. This is part of an ash handling system for discharging the refuse into a concrete overhead bin, whence it is carried away by railroad cars.

Fig. 17. From railroad cars, coal is dumped into a hopper under the tracks, whence it is fed through a plate feeder into a roll crusher. It is then delivered to the bucket elevator shown rising along the side of the structure and is carried up to the storage bin. From this bin it is distributed by a 10-ton man-operated traveling hopper to the several bins in the boiler house.



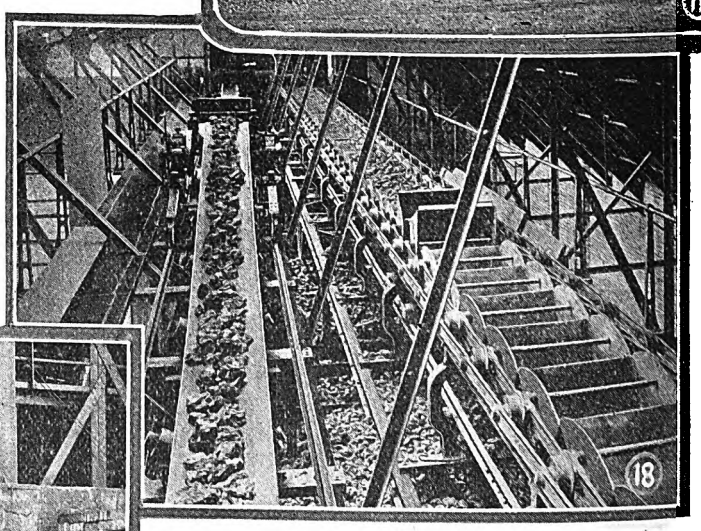


Fig. 19. The corrugated surfaces of an apron conveyor enable them to carry coal up steep inclines to a distributing belt conveyor over the bunkers.

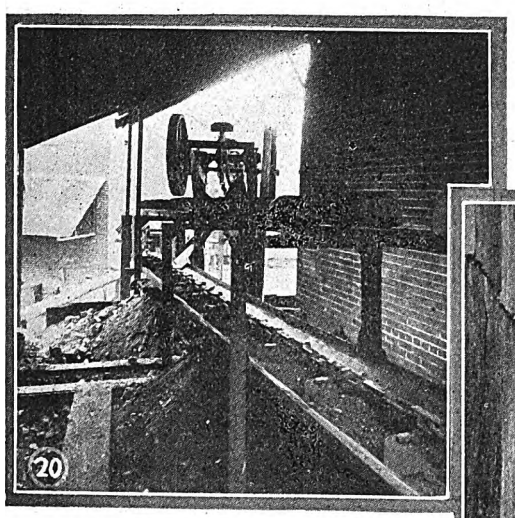


Fig. 20. A drag or scraper conveyor is adapted to service either for handling ashes or carrying coal. It is in successful use in many power stations for both purposes.

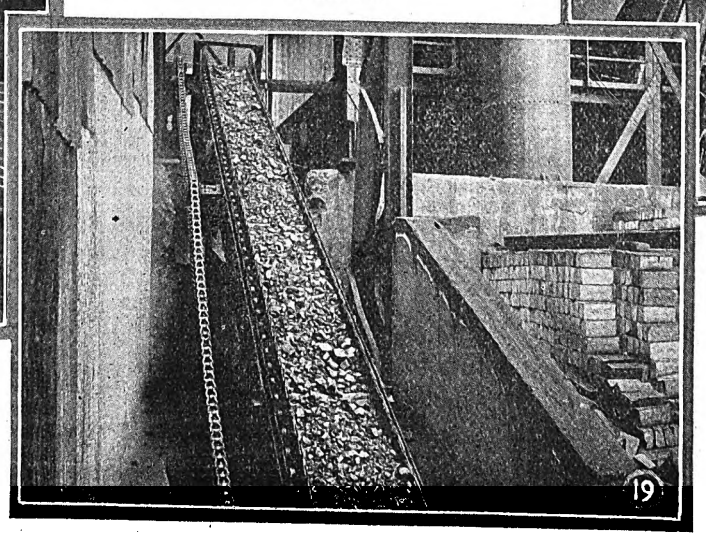
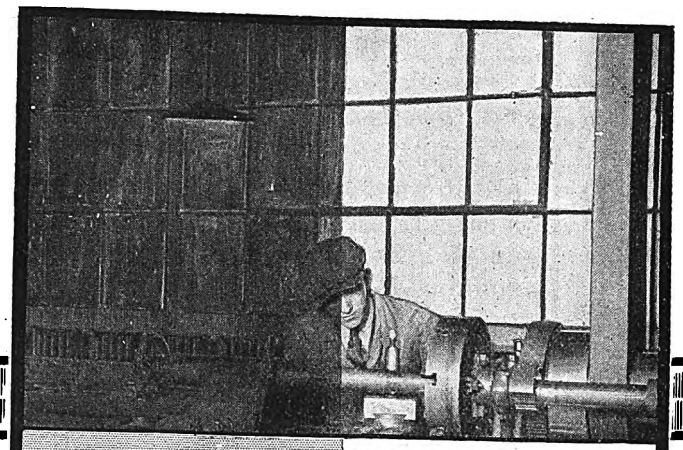


Fig. 18. Interior view in a boiler house showing the employment of both a belt type and bucket type of conveyor for carrying coal to the bins underneath. The bucket type of conveyor may also be utilized as an ash conveyor and it is sometimes designed to run through the ash cellar under the ash pits. The bolt conveyor is frequently used in conjunction with a bucket elevator for distributing coal in the bunkers.

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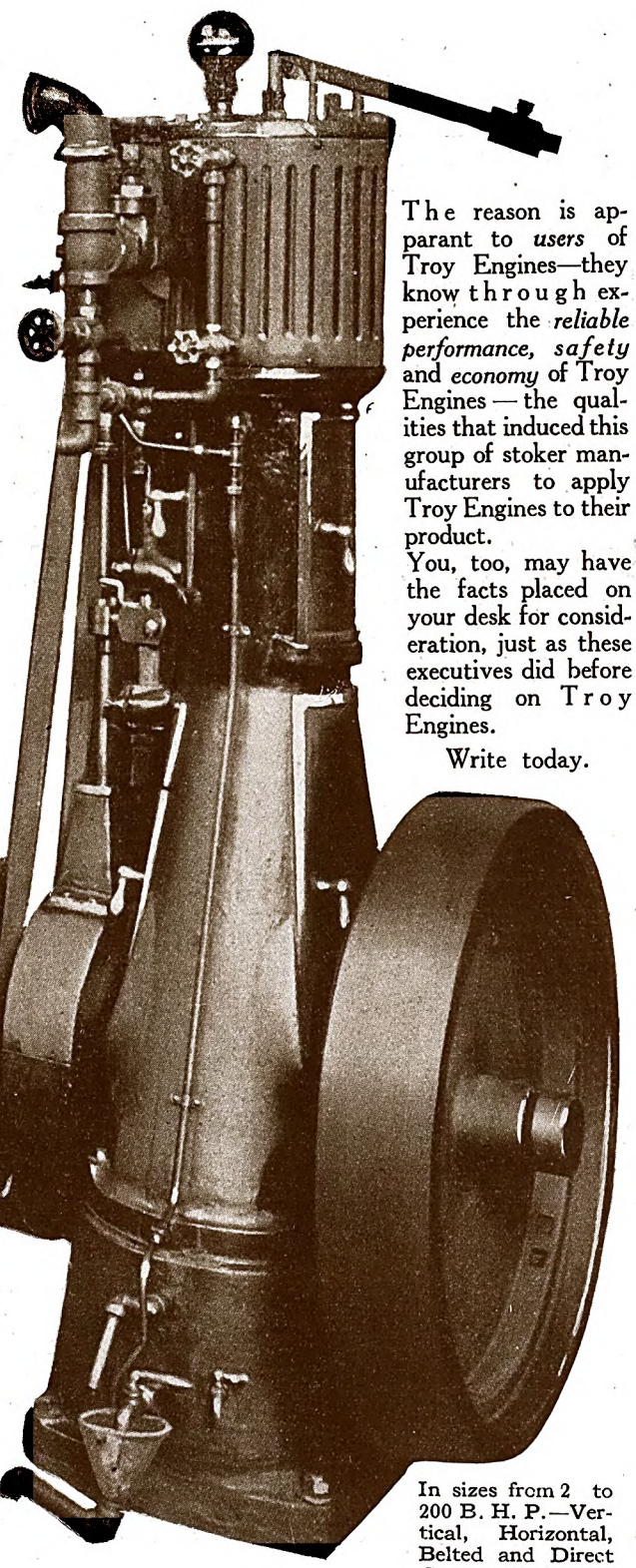
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(*Continued from page 23*)

Looking at figure 4, we see a different method of turning a corner. In this case, we have an endless platform conveyor running in a horizontal plane, turning all four corners at right angles. It will be noted that there is no return run to this conveyor, and the entire conveyor passes around the corner, the guard rails being an additional precaution to insure material remaining on the platform.

The heavy wooden slats are bevelled on the inner side, so as to permit turning the corner. One strand of heavy chain is used, which engages with a sprocket placed horizontally. The detail of drive by means of bevel gears is clearly shown. The entire conveyor and load is carried on the roller carriages which run on tracks, and which can be seen beneath the driving chain. This conveyor performs very heavy duty, and is therefore of very solid construction.

Using the same principle but different construction, we see in figure 5, a method of driving a continuous peeling table, now operating in modern canneries. The heart of a tomato canning factory is the peeling system, and such a conveyor effects a continuous movement of tomatoes and acts as a flywheel for the plant by systematizing and regulating the peeling. The conveyor keeps the peeler supplied with tomatoes, removing the buckets filled with peeled tomatoes, as well as the empty buckets and pans.

Figure 6 shows a close-up view which illustrates how easy it is to remove a bucket from the conveyor, and also how the conveyor structure supports the pan in which the peeler places the tomatoes. Peelers can work on both sides of the conveyor run.

In the manufacture of beverages, many standard conveyors are used in the handling of bottles, cases, etc., but figure 7 shows an ingenious use of the steel apron conveyor, for carrying grapes through and from the washer, up an incline, into the factory, where they are manufactured into grape juice. This conveyor is built along the standard lines of an apron conveyor, and is fitted with a sieve platform, which drains off the water. The angle construction on top of the platform provides ledges, to keep the grapes from rolling back on the inclined run. The gravity conveyor shown is not special.

We do, however, see in figures 8 and 9, a special gravity conveyor, and a special arrangement of a gravity conveyor. In figure 8, we see a conveyor for handling short lengths of steel shafting, between machine operations in a large congested machine shop. This conveyor is equipped with special rollers concaved, so that the shafting can be easily carried. With such congested conditions, it would be impossible to bring to, or take this material away from the lathe by hand truck methods. Other runs of gravity conveyor can be seen in the background. The special arrangement of gravity conveyor, figure 9, also shows the use of a special slat conveyor, fitted with attachments, for elevating pig iron at the Hercules Gas Engine Company, Evansville, Ind. The tracks upon which this equipment is mounted permits moving it in a horizontal direction, so as to unload cars which are spotted at various points on the track. The pig is loaded directly from the car to the slat elevator-conveyor, which discharges it to a run of gravity conveyor. This gravity conveyor is fitted with hinged sections, counter-weighted, one of which is shown opened at the end of the run. There are four of these counter-weighted sections in the entire run, and by opening these various sections, the pigs can be diverted into the different bins.

The gravity conveyor in this installation is special, because of the extra heavy construction required in the handling of pig iron.

After the car is unloaded, the slat elevator-conveyor is raised by means of pulleys and winches, as shown in figure 10, which permits the passage of trains on the railroad tracks, figure 10 also shows the general arrangement of the bins, and two of the gravity conveyor openings.

This is a special piece of

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machinery, designed to meet a special condition, but no doubt the same idea can be used in other industries for handling other materials.

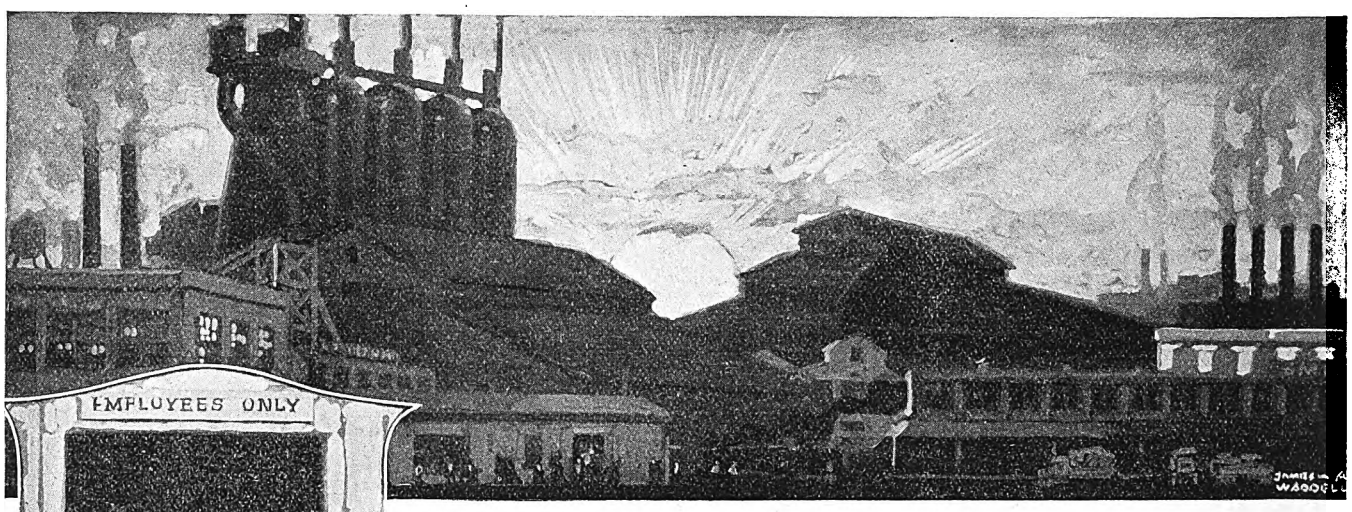
Another type of special conveyor, and one which it would be difficult to name, unless it is called a dolley conveyor, because of the carrying medium, is shown in different installations by figures 11, 12, 13 and 14. It will be noted that the conveyor consists of a number of four roller trucks, attached to an endless chain. Figure 11, is a reversible conveyor, 288 feet long handling 300 pound rolls of roofing paper between wharf and factory. In order to avoid accident a bell system is installed, and the code of bells is shown on the post to the left. One bell signal stops the conveyor, 2 bells start it delivering goods to the dock, and 3 bells start it delivering goods from the dock to the factory. This equipment is efficient, and economical of power, and when run at moderate speeds, has a very high capacity. The capacity of this particular conveyor is 300 rolls of paper per hour.

As stated at the beginning of this article the installations shown are special. Figure 12 shows a dolley conveyor feeding to a 70-foot arm elevator, by which barrels are delivered at any of five floors in a warehouse. The conveyor in this instance is 100 foot span, and runs beneath the street. The whole installation is synchronized and is driven by one motor. An automatic feeder is timed to deliver barrels properly to the conveyor, which in turn delivers them in proper timing to the elevator arms.

The handling of long rolls or pieces of material, has always been considered difficult. Figures 13 and 14 show how a conveyor will carry long rolls of oilcloth, linoleum, carpet, etc., and also the method of unloading this conveyor. The conveyor consists of 8 saddles fastened to a chain. The goods to be conveyed are loaded upon these saddles and conveyed either in a horizontal or inclined plane. The method of discharge is clearly shown in figure 14. At the end of the conveyor, the roll is delivered to rollers where it is discharged by the tilting of the roller and delivered to a platform.

There is no one industry that has made more use of special conveyors than the automotive industry. In practically every plant of this type, conveyors are used on all progressive assembly operations. Figure 15 shows how conveyors are used for assembling cars at the plant of the Willys Overland Co., Toledo, Ohio. This battery of conveyors saves considerable floor space, and insures the work being done within the allotted time. This conveyor consists mainly of a chain which pulls the chassis along on the angle tracks. This is one of the simplest types of conveyors, and represents what the engineers on this job consider the most applicable.

Figure 16 shows a chassis assembly conveyor in the Jordon Motor Car Company, at Cleveland, Ohio, which is the latest design for this purpose. It will be noted that the entire chassis is mounted upon special dolleys, which carry the car on rollers that run on tracks. This reduced considerably the friction, but the construction is much more expensive, than the





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Location of Floor or Room to be ventilated .....
How high do adjoining Buildings extend over your Roof? .....
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conveyor shown in figure 16.

The same type of conveyor is shown in figure 17, with the car a few feet from the delivery end, where it leaves the conveyor, entirely completed.

Materials handling equipment (elevators and conveyors) have done much in the development of the automotive industry, and if they were not used, the production would be considerably curtailed, and the expense of cars would be enormous. It is true that if so many cars were not manufactured, it would be easier for jay-walkers to cross the street, and it might therefore be a good idea to pass a law; that in order to safeguard pedestrians, we should prohibit the use of this equipment in the automotive industries. It would be just about as sensible as some of the arguments put forth as to why certain plant executives have not installed the equipment.

While the steel and other industries are crying shortage of labor, nothing is heard in this regard from Mr. Ford, and indeed he is increasing his monthly production of cars. How can he do this? For the simple reason that wherever possible, he has employed mechanical equipment, and now uses labor only on productive operations. His plant is not the only plant that has found it economical to install conveyors, and while two other automotive manufacturers have been mentioned, we see in figure 18, a motor assembly conveyor, 400 feet long, at the Chevrolet Motor Company, Flint, Mich. The saving of floor space and the fewer number of men required after the installation of this conveyor, is almost beyond belief.

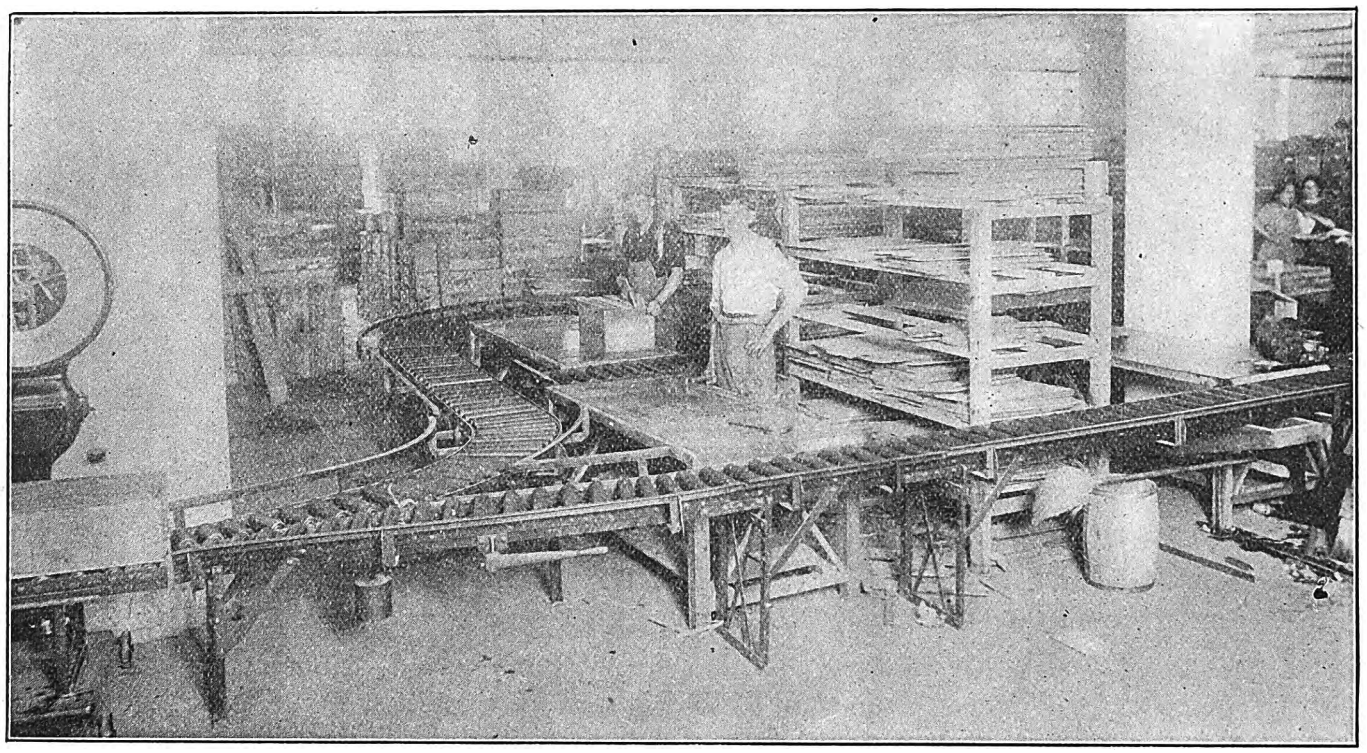
Particular attention should be paid to the turn table carrier, on which the motor is mounted while riding on the conveyor. This permits the workman to turn the engine at any angle he desires. Attention is also called to the placing of parts along the run of the conveyor, and the small work trough mounted on the conveyor supports for holding tools, etc. These special conveyors are not new though we are really just starting to develop the use of this class of equipment.

For years precedent ruled the foundry industry, and improvements were at a standstill. When quantity production was required, it was found that by the old methods considerable land was required to build a foundry of the desired capacity. In some instances, it was impossible to acquire this land, due to the price being excessive, or the land not being available at the desired location. Engineering skill solved the problem, and saved millions of dollars that would have been paid out in plant investment.

Figure 19 is a close view of one of the mould conveyors in the Kelsey Wheel Company foundry, Detroit, Mich. In this foundry, mechanical methods are used wherever possible. The result is enormous saving of space, cheaper production costs, and a minimum amount of unskilled labor.

While the automotive industries appear to be the most progressive, other industries are slowly learning the value of installing mechanical equipment for handling materials, and among this group are the meat packers, who have for

(*Continued on page 33*)



Not a dollar for repairs in thirteen years

Day in and day out for thirteen years this Mathews Gravity Conveyor System has carried a steady stream of boxes. It has saved countless steps and thousands of dollars in the packing and shipping room of the Larkin Company, Chicago. Yet it hasn't cost them a single dollar for repairs—and is still good for years of constant service.

That's the kind of service that is *built into* Mathews Conveyers. Mathews Rollers turn at the touch of a finger on case-hardened roller bearings. A loose cone insures even wear on the bearings. The roller itself is made of seamless steel. Each axle runs clear thru the roller, acting as an additional brace to the frame. And the roller frames are further strengthened by cross frames.

Those are a few of the reasons why Mathews Conveyers are giving this same kind of service in plants everywhere. And why ¾ of Mathews' installations are re-orders for additional units.

Every Mathews Gravity Conveyer System is planned by our engineers to meet the user's specific needs. They have made records of cutting handling expense as much as 75%. 50% is the average. You can easily figure the saving in your own plant—and when you're done that the cost of a Mathews System will be a secondary consideration.

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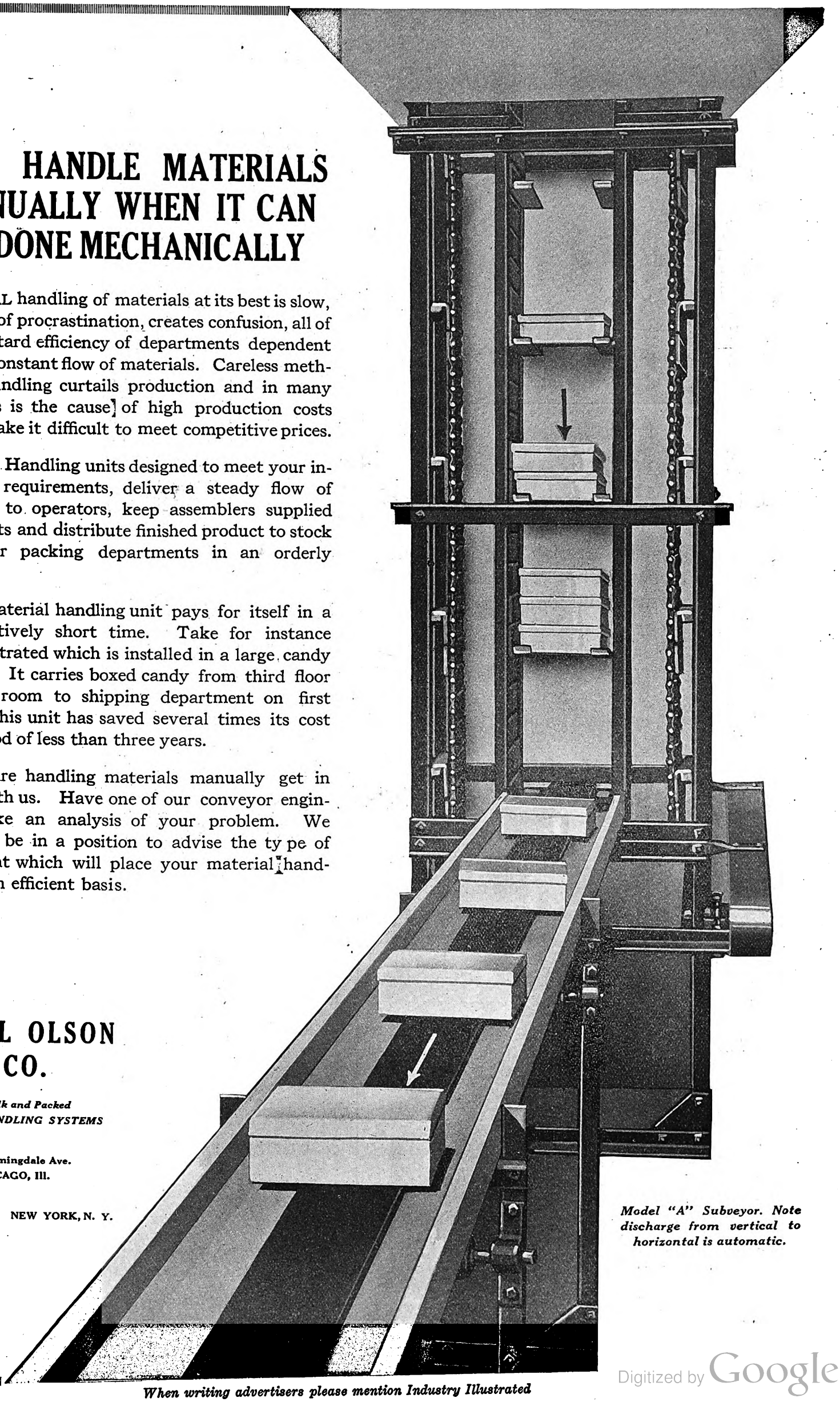
WHY HANDLE MATERIALS MANUALLY WHEN IT CAN BE DONE MECHANICALLY

MANUAL handling of materials at its best is slow, permits of procrastination, creates confusion, all of which retard efficiency of departments dependent upon a constant flow of materials. Careless methods of handling curtails production and in many instances is the cause of high production costs which make it difficult to meet competitive prices.

Material Handling units designed to meet your individual requirements, deliver a steady flow of material to operators, keep assemblers supplied with parts and distribute finished product to stock rooms or packing departments in an orderly manner.

Every material handling unit pays for itself in a comparatively short time. Take for instance unit illustrated which is installed in a large candy factory. It carries boxed candy from third floor packing room to shipping department on first floor. This unit has saved several times its cost in a period of less than three years.

If you are handling materials manually get in touch with us. Have one of our conveyor engineers make an analysis of your problem. We will then be in a position to advise the ty pe of equipment which will place your material handling on an efficient basis.



Model "A" Subveyor. Note discharge from vertical to horizontal is automatic.

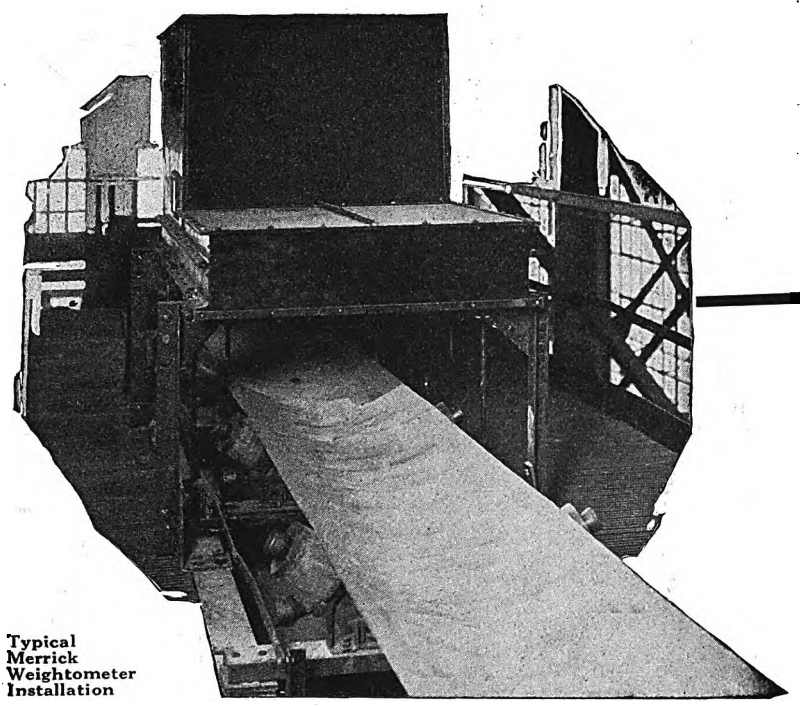
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MATERIAL HANDLING SYSTEMS

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Typical Merrick Weightometer Installation

Weigh the Merrick Way— if Conveyors Handle your Materials

The Merrick Weightometer weighs conveyor-handled material *while in transit.*

No labor is required—it is automatic and records the weights as the materials are conveyed over the belt.

The Merrick Weightometer is reliable; in fact, we guarantee it *99% accurate.*

Why rely on Bill of Lading Weights? Why not be able to tell exactly how much material you ship or receive?

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is in use in hundreds of plants for weighing Coal, run o'mine and crushed; Coke, Stone, coarse and fine; Gravel, Sand, Cement Rock, Phosphate Rock, Phosphate Pebbles, Wood Chips, Sulphite Pulp Slabs, Fish and Fish Products, Ores, Etc.

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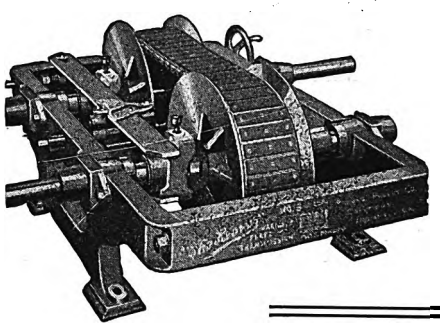
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VARIABLE SPEED TRANSMISSION

WHAT IS IT?	The most perfect mechanism procurable for the purpose of Transmitting— **VARIABLE SPEEDS**
WHAT WILL IT DO?	Give the exact speed desired, even to a fraction of a revolution on any machine or conveyor which you wish to regulate.
WHEN?	Whenever you want it. You can change the speed as often as necessary or maintain any speed indefinitely.
HOW?	By turning the adjusting wheel until the exact speed is obtained. This can be done without stopping or interfering with production.
WHERE IS IT USED?	On any conceivable kind of machine or conveyor where a sensitive variation of speed is required.
WHAT DOES IT COST?	NOTHING—because it saves its cost soon after installed and makes continued saving as long as used.
HOW CAN I PROFIT?	By submitting your variable speed problems to us.

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REEVES PULLEY CO.
COLUMBUS, INDIANA

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(*Continued from page 30*)

years used overhead conveyors or small track trolleys, and who are now investigating the use of tractor trailer trains, lift trucks, etc. Figure 20 shows how a chain with attachments can be used as an aid on the inclined up-haul for elevating sides of beef. The operation is entirely automatic, the carriers releasing themselves from the haul at an offset in the track, and roll thence through a doorway into the building.

Frequently installations of materials handling equipment are condemned because they do not operate successfully, and the causes of these unsuccessful operations are sometimes never investigated. Those given a complete investigation have, in a number of cases, shown that the apparatus was not being properly fed, or the discharge was not properly designed. This has led to the use of special feeding devices for the loading and unloading of elevators and conveyors.

Figure 21 illustrates a self feeding barrel elevator. The feeding conveyor consists of two strands of chain, fitted with pusher attachments, at suitable intervals, for proper barrel spacing. The conveyor is driven by the same motor that operates the elevator, and the timing is such as to deliver a barrel to the elevator as an elevator tray is ready to receive it. By using this feeding mechanism, no empty trays are carried on the elevator run, and there is an assured capacity of eight barrels per minute.

Another and different design is shown in figure 22 for handling rolls of paper to a rigid arm elevator, in one of the largest publishing houses in the world. The rolls are first placed on the stationary fingers, from whence they are lifted by the fingers on the conveyor as shown. The conveyor elevates it to another set of stationary fingers, and at just the right moment, so it will be immediately picked up by the rigid arms of the elevator, which carries the roll between floors. This elevator has a capacity of 90 rolls of paper per hour, varying in length from 32 inches to 68 inches and weighing from 900 to 1,800 pounds.

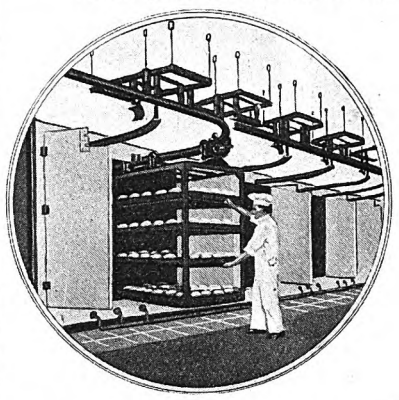
The illustrations show a number of industries that are successfully using this class of machinery, and while the materials handling manufacturers have a large field for their product in this country, they have also developed a use for it in foreign countries, and it might be said that some foreign countries are more progressive in the use of this equipment than we are. For the simple reason that, as we receive immigrants into this country, they lose unskilled labor, due to migration.

Figure 23 shows a portable conveyor, for loading vessels at a port in Australia. This equipment is of American design. It is pivoted in the center, and can be raised at outboard end to suit height of deck, being mounted on a travelling support, that has a longitudinal and transverse movement. It can handle 3,600 bags per hour.

There is no materials handling problem that if put in the hands of the manufacturers or a capable engineer, cannot be solved, either by using standard equipment or by designing special equipment.



FLOUR—TO MIXER AND BALLER—THROUGH PROOFER—TO MOULDER—TO BAKING OVENS—TO WRAPPING MACHINE TO SHIPMENT ⟶



In the Bakery—flour and bread handling methods are greatly improved—the operations are quicker and easier—floor space is conserved—production increased—dust from rolling racks eliminated—and a dozen other advantages—each one a money maker—secured by the use of a *Cleveland Tramrail.*

It's a simple one rail system that hangs from the ceiling beams or roof trusses and is arranged to run through the ovens. It will unload barrels of flour—carry racks of bread—and even load the trucks and wagons.

A "dough" saver in production costs
The handling of flour, dough and bread by hand shoots production cost sky high. A decided saving from the handling of the flour on through until the loaf is wrapped will be realized in every Bakery equipped with a ..... Cleveland Tramrail System

It's a man, time, and labor saver that soon pays for itself.

Shall we send more facts?

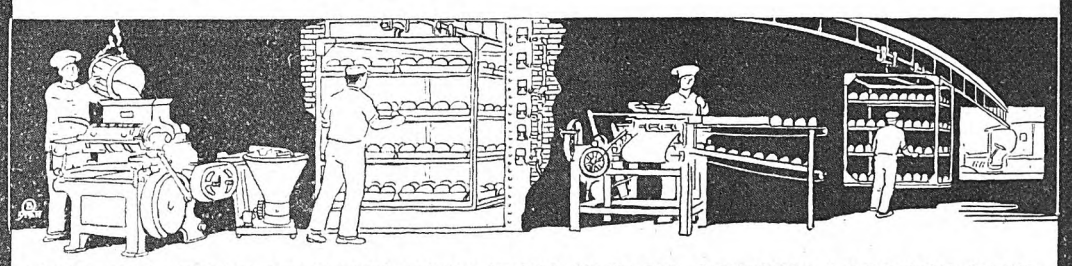
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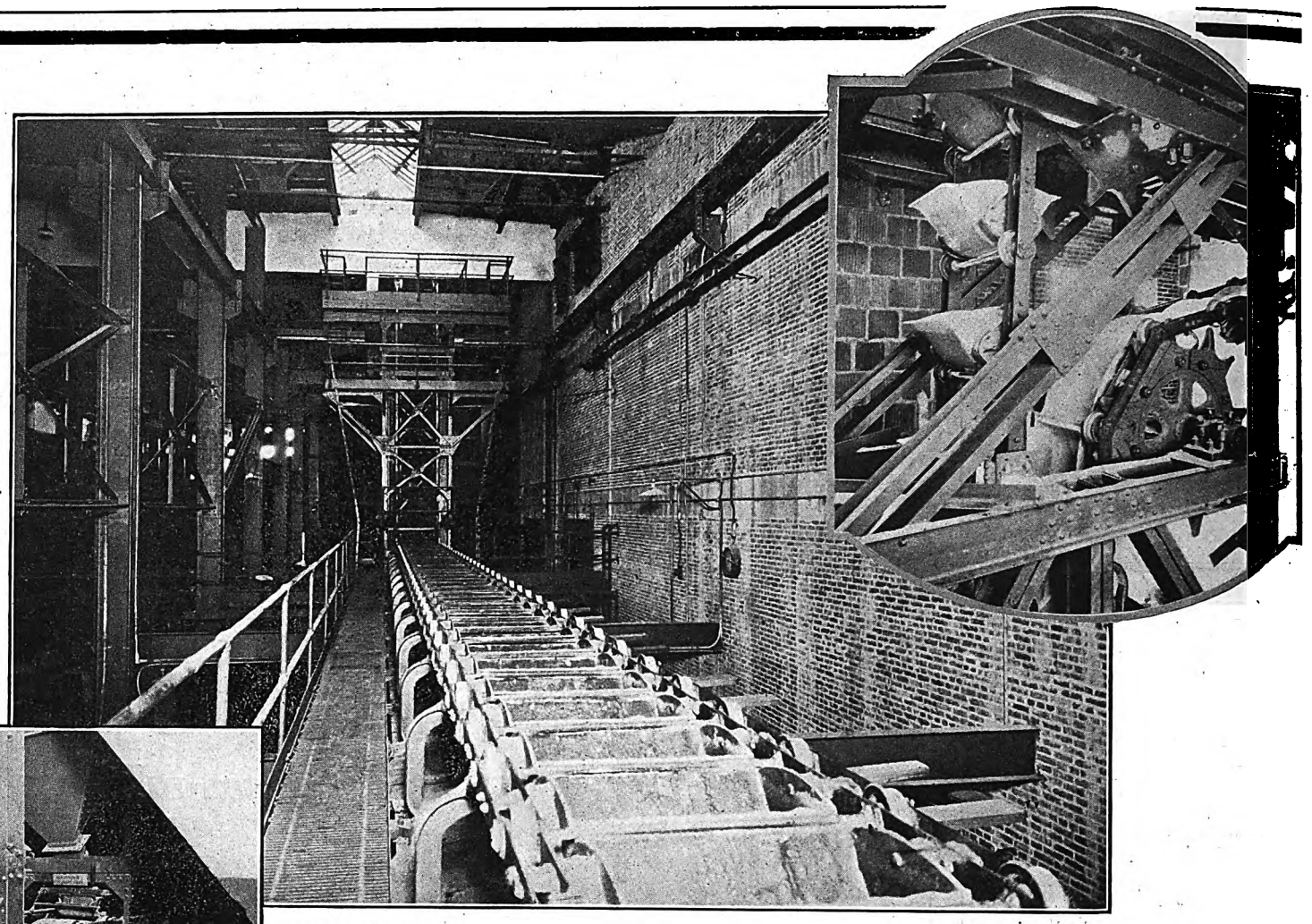
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TO AND FROM THE MIXER AND ROUNDER—THROUGH PROOFER—TO MOULDER—THEN THROUGH THE BAKING OVENS—TO THE WRAPPING MACHINE—TO DELIVERY WAGON—BREAD IS EASILY AND MORE ECONOMICALLY HANDLED VIA

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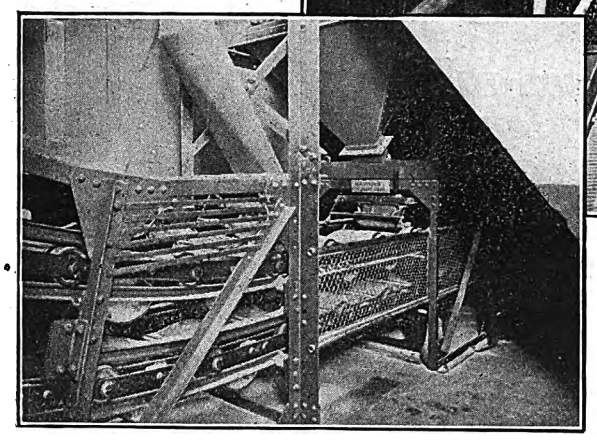
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Upper Insert shows a corner of the aluminum Pivoted Bucket Conveyor.

Lower Insert—From the 2,000,000 lbs. storage bin sugar is drawn off into bags or barrels or fed to the Jeffrey Pivoted Aluminum Bucket Conveyor.

Center—A Jeffrey Pivoted Bucket Conveyor alternately fills and empties the storage bin containing the raw sugar.



The Aluminum Bucket Conveyor at the American Sugar Refinery Is a JEFFREY

"Hundreds of sugar refiners, chemists, wholesale consumers, engineers, and others interested in the industry, have visited this refinery and gazed in admiration at the many labor-saving and efficiency-producing devices for elevating and conveying such a wide variety of materials——from coal to powdered sugar."

From the Article

"Material Handling in a Modern Sugar Refinery"

by Homer L. Rank, May Industrial Management

The aluminum Pivoted Conveyor buckets—the last word in cleanliness and the first to be installed, described in this article, were designed and installed by The Jeffrey Manufacturing Company. The illustrations tell the story of material handling equipment that greatly help in cutting production costs. Another example of man-power displaced by machinery.

This is typical of the aid given by Jeffrey Engineers throughout industry, in the proper selection of the equipment exactly suited to the conditions.

Modernized conveying equipment will bring your plant to the standard required by the demands of quantity production.

Write us your requirements. A trained engineer-salesman will help you in working out your particular problem.

JEFFREY

Standard Labor-Saving Equipments Include:

Conveyors of various types; Portable Bucket Loaders; Portable Car Unloaders; Portable Belt Conveyors; Elevators; Chains; Crushers; Pulverizers; Shredders; Coal and Ashes Handling Equipments; Skip Hoists; Electric Industrial and Mine Locomotives; Coal Tipple and Mining Machinery, etc.

The Jeffrey Mfg. Co., 946-99 North Fourth St. Columbus, O.

JEFFREY

MATERIAL HANDLING MACHINERY

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The Elimination of Re-handling

(*Continued from page 16*)

legs. Also pressed steel platforms and structural steel skids are becoming more common. Structural steel and pressed steel construction makes the initial cost high but the maintenance expense is low, and accidents due to collapsing of the legs are unheard of.

Skids have now been developed to handle practically all classes of materials, and thus concerns handle odd shaped and cumbersome pieces that would be difficult to handle in any other way. For example, figure 16 shows a rack superstructure on a skid, for handling axles and other parts of similar shape. In this case, six of these combersome pieces are picked up and transported from one operation to another by the lift truck and its operator, without any other assistance.

Another place where the use of skids is of advantage, is in the handling of heavy castings or complete assembled machines, as in the case of figure 4; by having these machines mounted on skids as shown, it is possible for the lift truck operator to pick them up unassisted, and carry them to various departments within the plant for inspection, or to the shipping room for shipment.

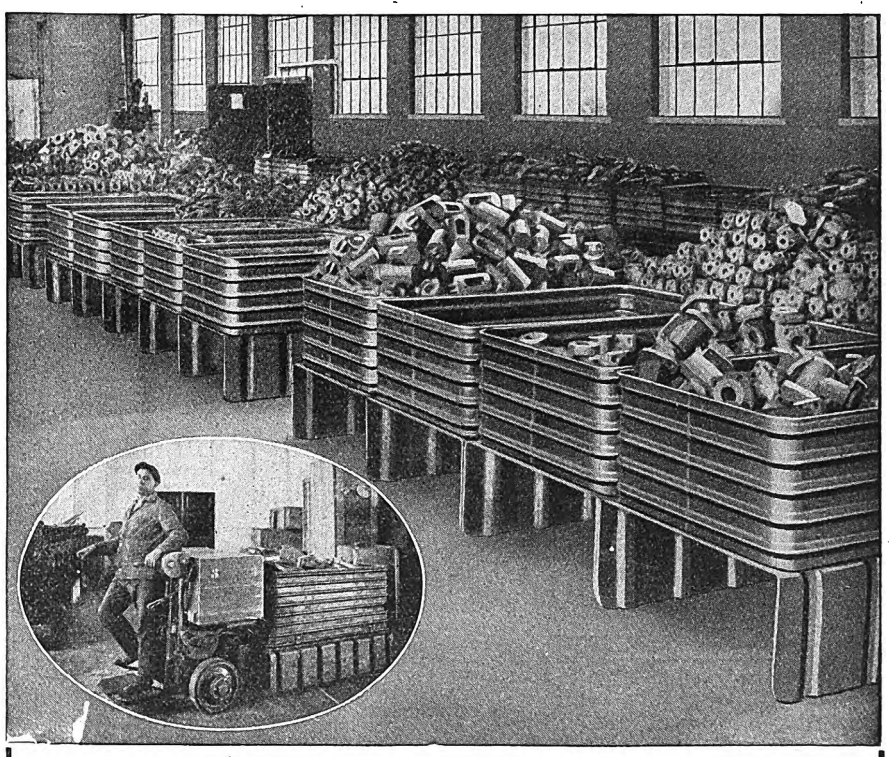
Car unloading and car loading has always been considered a job for hand trucks and common labor, but the use of elevating trucks and skids has materially reduced the cost of this operation, and also makes it possible to unload and load cars much quicker than the old hand methods. Figure 1, shows how the skid on a hand elevating truck can be drawn directly from the car to storage. There is no necessity for re-handling this material and the skid and its load can be placed in storage intact, thus permitting quick re-handling when the goods are taken into the manufacturing process. The correct way to unload a car with skids, is to place three or four empties in the car at the start and when the trucker is taking a filled load to storage, the men remaining in the car simply start to pile materials on an empty skid. After the second or third load, the hand trucker brings more skids so that the men in the car always have skids to pile goods on, and there is no delay.

Figures 2 and 3 show a method of loading cars. The skids are piled with bags directly from the filling machine, and the electric lift truck picks up the loaded skid and transports it directly into the car for stowing. There is no delay to the power equipment because as soon as the skid is placed in the car, it returns for another load. The empty skids are placed outside the car in a neat pile, and on one of the return loads, the truck operator carries them back to the point of loading.

Where it is necessary to move materials by means of trucks, the use of lift trucks and skids will reduce the capital investment and show a savings in labor costs and maintenance costs over platform hand truck methods. If a plant is now using from 50 to a hundred ordinary hand trucks to perform the work, there is no doubt but that two or three lift trucks and from 50 to 100 skids would do it more efficiently, and at less expense. If a new installation is considered, the skid and lift truck method will permit of a smaller investment than would be the case if platform hand trucks were purchased. We will assume that a platform hand truck will cost on the average of $30 apiece, and 100 are required. This would make an investment of $3,000. A well constructed wooden skid in lots of 100, should cost $15 each, or an investment of $1,500. Hand lift trucks of which 3 might possibly be required, would cost approximately $125 apiece, or an investment of $375, making a total investment for skids and lift trucks, $1,875.00. Therefore, in making a comparison, we have

100 platform hand trucks	$3,000
3 hand lift trucks and 100 skids	$1,875
Reducing the initial investment	$1,125.00

(*Continued on page 37*)



There Is No Economy in Makeshifts

When the output of your machines is placed in Truscon Steel Boxes on Truscon Lift Truck Platforms, you know your production is always moving. There is no economy in handling material on equipment that wiggles and wabbles or collapses in your factory aisles and runways.

It makes no difference if they are white hot forgings or just cold steel; you can't overload Truscon Platforms or Boxes. They won't warp or get out of shape. They smile at abuse.

Whether you use hand or power lift trucks, overhead conveyors or cranes, or any other method of moving material, you will find a Truscon Steel Platform or Box that will carry the load.

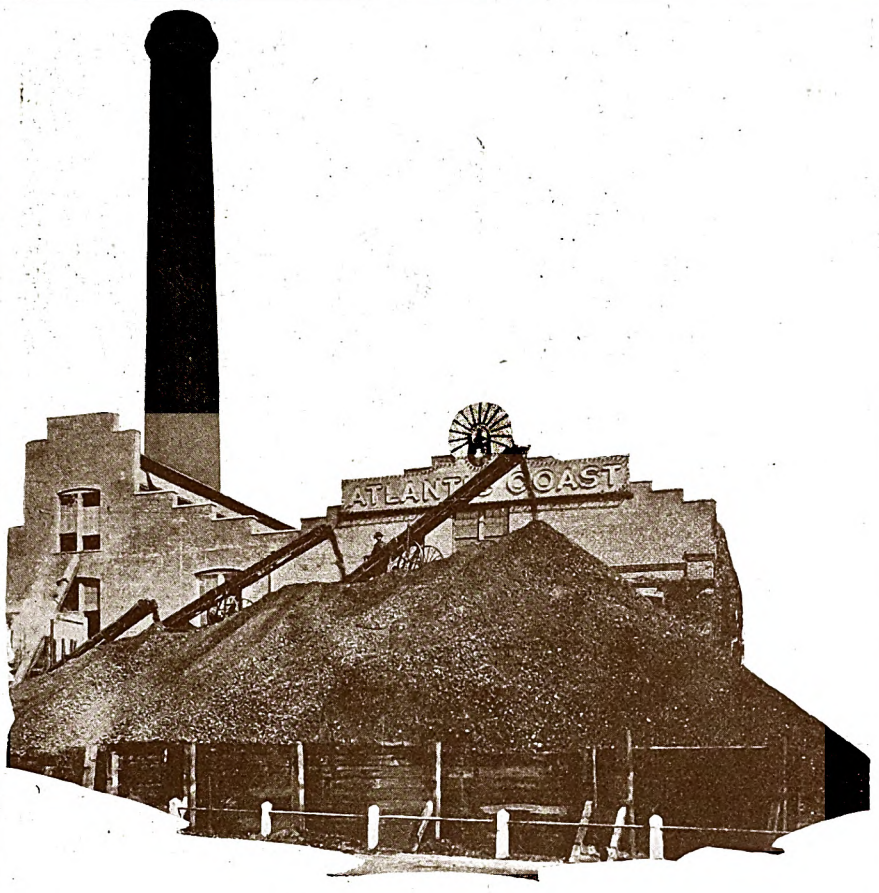
Remember, there is no real economy in makeshifts. Write today and get a line on how Truscon equipment can save you money.

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ALLOY STEEL PLATFORMS AND BOXES

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Store Your Coal Now

LEARN by your experiences of preceding years, a good pile of coal in storage is your best insurance against strikes, snow storms, car shortages and high prices.

The illustrations show storing coal with the Scoop Conveyor at the power plant of the Atlantic Coast Electric Railway Co., Asbury Park, N. J. These machines unload direct from cars and deliver on this pile. Later in the year the same machines are used for reclaiming into boiler room.

This light-weight portable conveyor is a complete answer to conveying problems at thousands of plants and its first and operating cost is but a fraction of the cost of a more elaborate, but no more capable, conveying system.

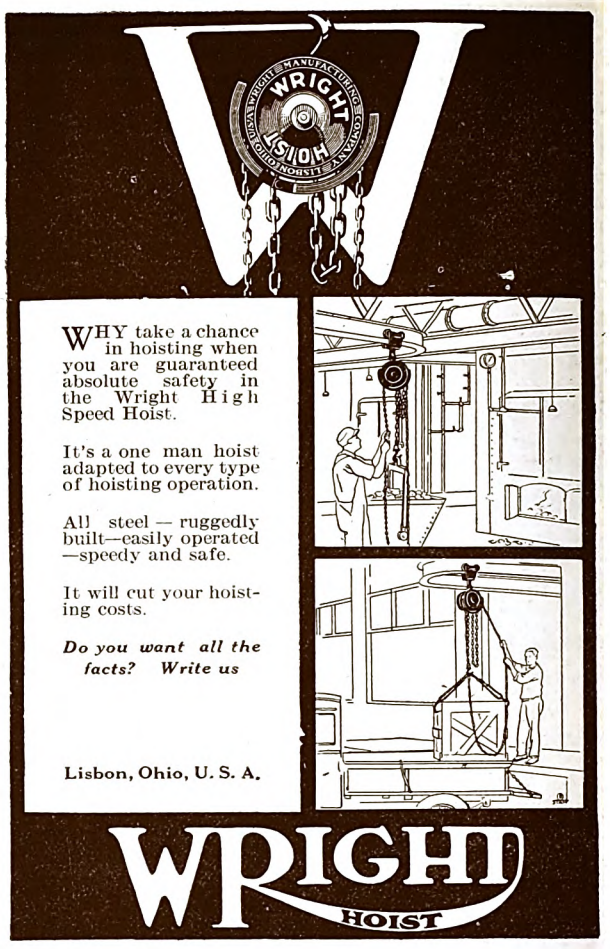
You too, can avail yourself of the immense time and money savings possible with this machine.

Write for Catalogue No. 158 Now.

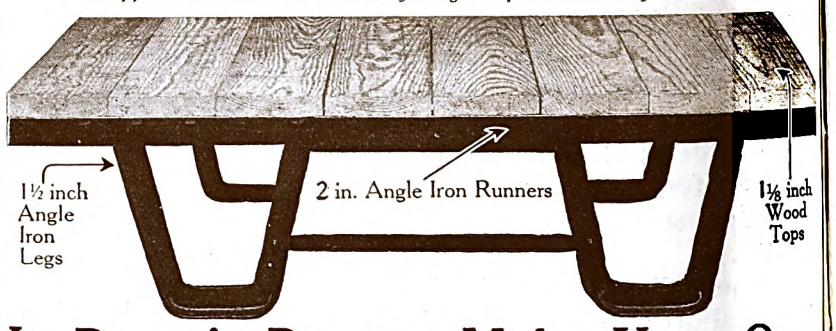
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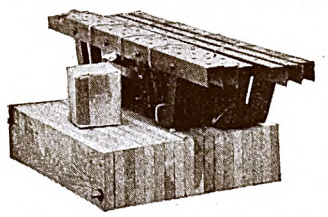
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It Doesn't Pay to Make Your Own Truck Platforms



Three Enterprise Platforms ready for shipment, showing why they take a class 3 freight rating.

Made in all Sizes

If you will give us the following information we will quote you promptly on a platform to meet your requirements:

Measurements Desired

Length of top over all . . . . . .
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Clearance between runners . . . . . .
Style elevating truck used . . . . . .
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Important Notice

We ship complete, with necessary bolts, nuts and lock-washers, everything ready to assemble. Top boards of platform finished four sides, cut to length, bored and countersunk for bolts.

When you can buy Enterprise Platforms, stronger and more durable, that will last indefinitely without costly repairs or replacements. The Enterprise Platform will not break down under heavy loads like all-wood platforms. It is built to stand the most severe usage. In final cost the least expensive platform you can buy or make—less expensive than many in first cost. It is the only combination steel and wood platform shipped knocked down at a low freight rate with everything complete, ready for immediate assembly. Send measurements and get full information and prices.

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HALLOWELL
STEEL LIFT TRUCK PLATFORMS



Save Renewals and Repairs on Lift Truck Platforms BY USING THE "HALLOWELL"

From time to time the all wooden construction must be repaired, and finally complete replacement is necessary, therefore, the initial investment is only a small part of the ultimate cost.

The robust design of the "Hallowell"—heavy steel angles and steel leg holders being securely joined by hydraulically driven rivets—renders it practically indestructible and, therefore, a very profitable investment.



Ends of runners are flared, as shown by above illustration, an exclusive "Hallowell" feature, which greatly simplifies entering the truck.

The value of this feature is soon realized by the workman after platform is put into service.

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(The "Pioneer" Steel Hanger People)

INVESTIGATE

STANDARD PRESSED STEEL COMPANY, JENKINTOWN, PA.
Gentlemen: Kindly send me full details and prices of "Hallowell" Steel Reinforced Platforms.

Name.....

Company.....

Address.....

Truck used.....

(Continued from page 35)

In addition, it is easier and cheaper to maintain the three lift trucks and their mechanical parts, than it would be to maintain 100 platform trucks. However, the savings in first cost is not the only advantage. There is another advantage, that of saving space. When ordinary platform hand trucks are not in use, they require the same amount of valuable floor space as when they are in use. In the case of skids, it is simple to nest them when not in use, so that they can be stored in any out-of-the-way corner of the plant.

Another advantage of this system is that damage to goods in transit and between operations is eliminated. No matter how carefully goods are handled, and whether they are fragile or machine parts, there is invariably some damage or breakage caused. With racks and special skids, designed to carry finished parts, and by using this system of transportation, the continual handling of parts is practically eliminated, and materials are rarely damaged by the carelessness of the trucker, because the trucker no longer handles them. He simply picks up the entire skid on which the materials are loaded, moves it to the desired location, and sets it down again. No time is lost between operations, no delays or tie-ups of machines waiting for materials to be taken away, or brought up.

In most manufacturing plants, the use of this system of transportation invariably increases production.

The handling and re-handling of sheet tin is difficult and dangerous. In the first place it is heavy and the sharp edges frequently cut the hands of the workers. In the process of making tin into various utensils, it is often handled several times between car and finished product. By using skids and lift trucks, the only time the raw tin has to be handled is at the car, and it can be put in storage on the skids as shown in figure 9. The lift truck can then pick it up without re-handling, and convey it to the point of consumption.

The use of skids is not limited to any industry, and today this type of transportation is

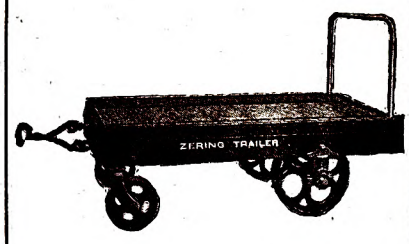
The Lift Truck Platforms that move without the Lift Truck



Time and tide waits for no man—neither do the Zering Live Lift Truck Platforms wait for the man with the Lift Truck. You can move it as soon as it is loaded and avoid delays and lost time on short hauls.

They are made in steel or wood, and are equipped with quick swiveling Zering Ball Bearing Casters. They will move the heaviest loads easily and economically, cutting down your stock in process to the minimum.

Write for prices now and solve the labor shortage problem.



Zering Trailers

Zering Trailers have made a reputation throughout industry for their sturdy construction and dependability.

Tie bolts running the full length and the corners securely locked, prevent the trailer from becoming wobbly or saggy.

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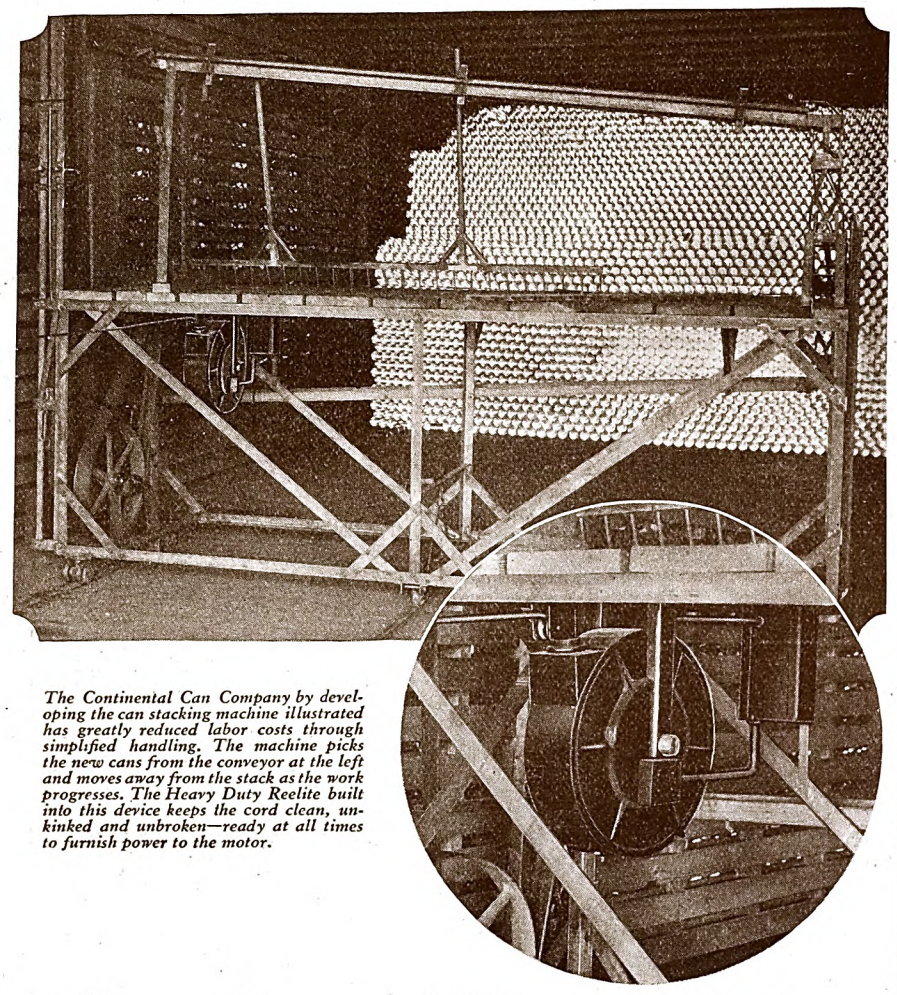
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The Continental Can Company by developing the can stacking machine illustrated has greatly reduced labor costs through simplified handling. The machine picks the new cans from the conveyor at the left and moves away from the stack as the work progresses. The Heavy Duty Reelite built into this device keeps the cord clean, unkinked and unbroken—ready at all times to furnish power to the motor.

True Portability for the Portable Machine

The new Heavy Duty Reelite opens new fields for development in portable machinery. This unit can be incorporated in new machines or attached to existing devices to definitely end the worries of portable cord maintenance. There are many situations where bare current conducting rails are not practical from either a safety or operating standpoint. And loose cables dragged over floors, through oil, and under the wheels of trucks always require repair with a loss of operating time for the machine.

The Heavy Duty Reelite pays out cord of practically any size and number of conductors and then automatically retrieves it when no longer required. It is furnished with 1″ male-threaded hubs for mounting on the machine, and knockout for conduit connection for current supply. Our engineers will be glad to give any information or assistance possible in the adaptation of Reelite to your requirements.

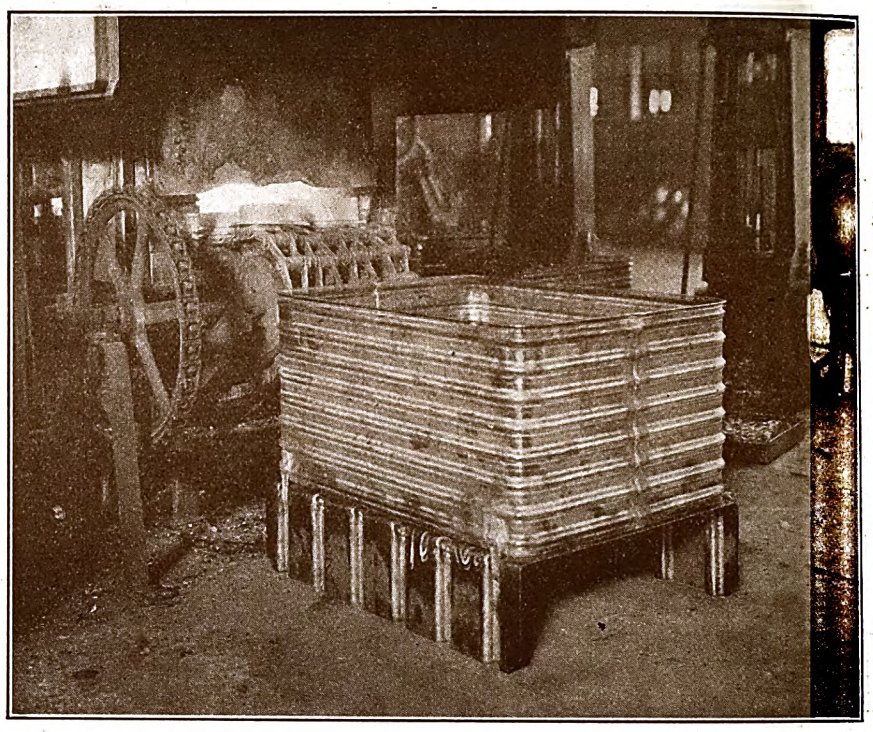
APPLETON ELECTRIC COMPANY
Factory and General Offices
1716 Wellington Avenue
CHICAGO

HEAVY DUTY Reelite
REG. U.S. PAT. OFF.

used in practically all industries, also in public warehouses and produce exchanges. Chemical plants, tanneries, and places where acid conditions exist, are particularly severe on moving parts, and mechanical equipment. Ordinary platform hand trucks and other types of hand trucks that are required to stand around in these acid conditions, frequently last for only a period of weeks. By using skids, the number of moving parts and trucks is materially reduced, and these trucks can be removed from the acid conditions when not in use. The goods can be loaded on skids, as shown in figure 5, which can be constructed of material of an acid-proof nature, or protected by acid-proof paint. This greatly reduces equipment maintenance costs, and will also bring about the other benefits of reduced direct labor expense.

The length and shape of the load is not always an obstacle to the use of this system of transportation, and many special long or wide trucks have been built to take care of particular installations. Figure 3 shows a special hand lift truck, nine feet long, and handling pipe about 14 feet long. This installation has proved successful under actual operating conditions.

The handling of cores in foundries has always proven difficult, because of their fragile nature, but the use of special rack skids and electric and hand lift trucks is now effecting enormous savings. Figures 20, 21, 22 show the installation of an electric truck in a large foundry. The placing of the rack skid at the core-maker's bench has reduced several handlings in this plant, and the cores are handled only twice, that is, when the coremaker



places them on the rack, and when the molder places them in the flask. On other movements, the entire rack is picked up by the truck as shown.

Another advantage obtained by this installation, is a material saving in heat losses, which were enormous with the old type of oven carriage. This carriage operated on a track, and only moved slightly beyond the edge of the oven for unloading. This required the doors of the oven to remain open, and the stored up heat escaped. Now the oven doors are only opened for a few moments, to permit taking out of a loaded rack, and placing a new one within the oven.

Similar rack skids are now being used in concrete block and brick industries, and as many as 500 concrete bricks are being carried direct from briquetting machine to bake oven, as shown in figure 29.

Dump body skids are a recent development, and are now being found in many plants for handling refuse. Frequently these skids are placed at points where refuse is accumulating showly, and at regular intervals the electric lift trucks cover the route, picking up each individual skid, and at the same time, leaving an empty

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THE TOWMOTOR VS THE LABOR SHORTAGE

THE CHANDLER MOTOR CAR COMPANY
CLEVELAND, OHIO, U.S.A.

May 1, 1923.

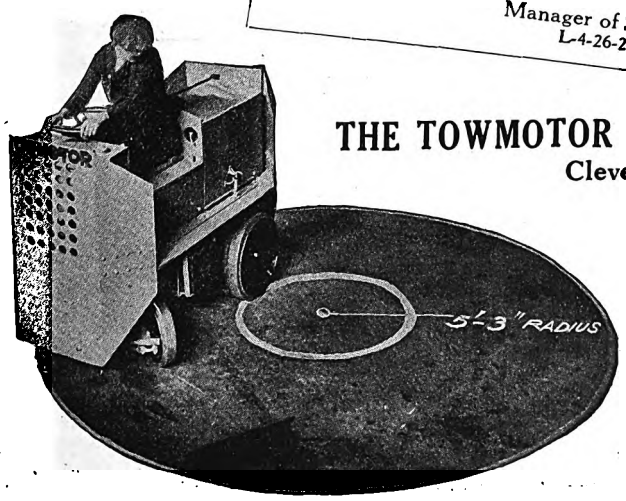
The Towmotor Co.
Cleveland, Ohio.
Gentlemen:

In reply to your letter of April 26th pertaining to our experience with the Towmotor.

We are under the impression that it is the most essential feature in any manufacturing plant. We have no hesitation in saying that our Towmotor has paid for itself many times over, and can accomplish in one day the work of fifty men. Its durability and upkeep under rough usage are more than surprising.

Very truly yours,
THE CHANDLER MOTOR CAR COMPANY

Signed: J. W. Whitehouse
Manager of Service.
L-4-26-23



THE TOWMOTOR COMPANY
Cleveland, Ohio

in its place. This is easily accomplished by having one or more extra empties with which to start the endless chain. This empty is placed at the first point, and the filled skid is taken to the dump. On returning, the truck operator has an empty skid which he takes and places at the second point, removing the loaded skid. Thus, he never returns to the same point twice, unless it is required to remove two skids.

In machine shops, where small gears, cams, etc., are manufactured, as well as in the manufacture of phonograph and armature discs, the use of spindles mounted on the skid platform, (Fig. 17) prevents the load from slipping, and eliminates damage to the products. If the products are not so highly finished, or if they are rough castings, a box section which can be mounted on the platform, will be found more economical, because it can be dumped more readily, and will frequently hold more material.

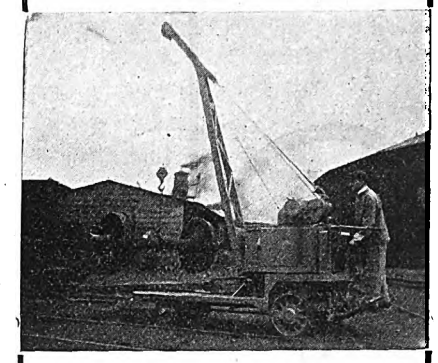
Figure 15, illustrates a collapsible rack or box section, for use with platform skids. This collapsible section permits empty skids to be stored in very small space.

While the majority of illustrations show skids with permanent legs, the advantage of live or caster skids should not be overlooked. By having the skids equipped with a full size set of wheels, two of which, or four of which, can be swivel, so as to permit turning, many advantages are acquired, and it is possible for machine operators to move the loaded skid for short distances when hand trucks or electric trucks are not available. It also makes it easier to move a skid out of the way in case it is obstructing the aisle or a piece of machinery.

Another idea which is not shown in the illustrations, but which is of decided advantage, is a skid with legs so designed that a lift truck can approach it from one of four sides when lifting it and not make it necessary to approach it only from one of two ends. The writer does not know of any standard skid that permits this. He has, however, been in plants where the engineering department has developed such a skid and manufactured it in

(Continued on page 41)

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Electric Industrial Trucks and Tractors

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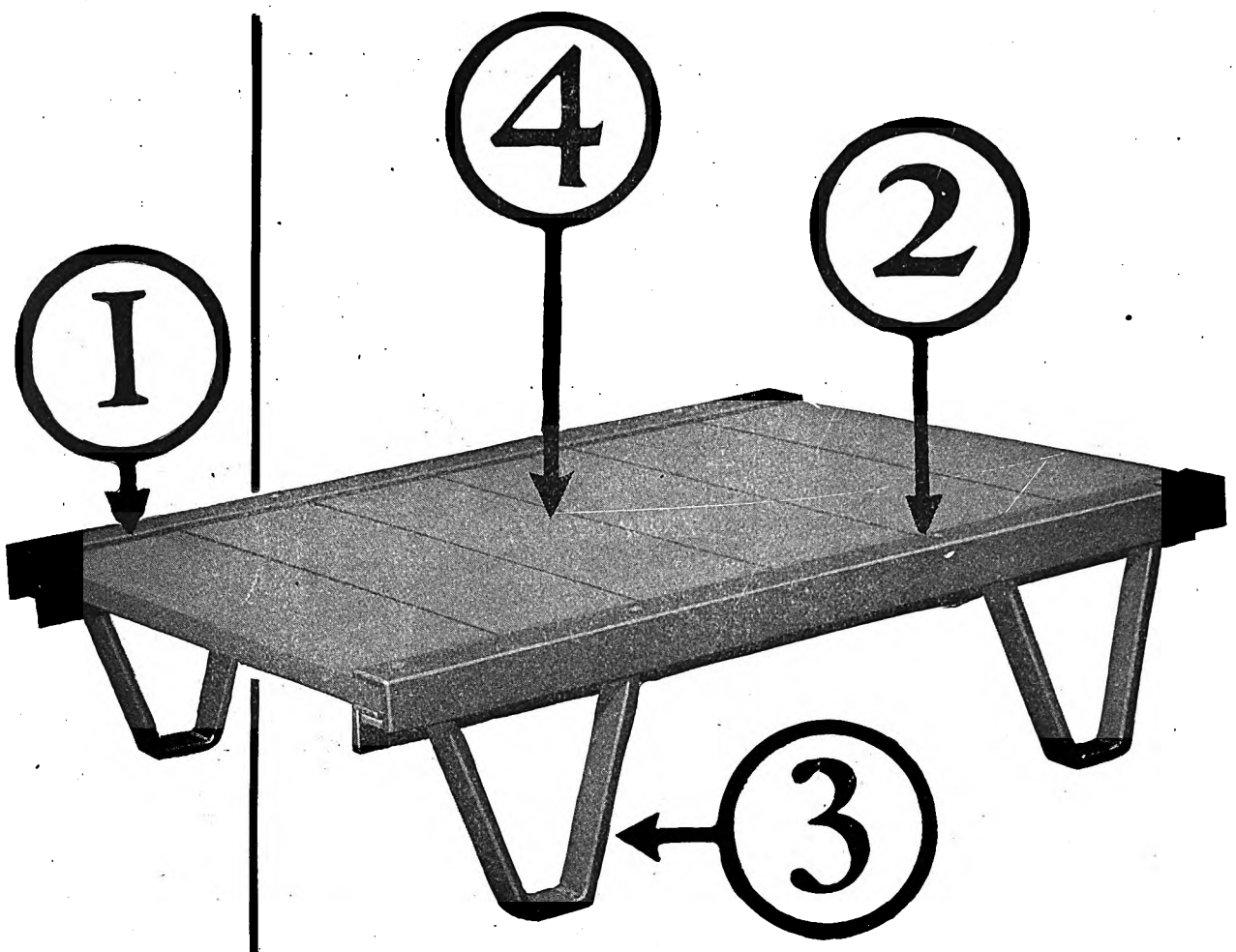
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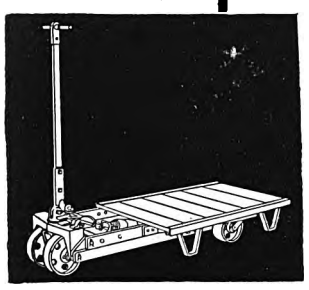
1 ***Steel-Bound the full length.*** Powerful clamping prevents sagging. Strongest where ordinary platforms are weakest.

2 ***Forged steel bolts*** with large heads anchored in the steel rails clamp oak top, side rails and steel legs together in a vise-like grip.

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For instance, genuine Stuebing "Steel-Bound" Platforms can be had for

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This platform is a most popular size—30 in. wide x 36 in. long x 6½ in. high. Other standardized sizes, covering a wide range of widths and lengths, can be had at proportionately low prices.

Don't "make the best of it" with wooden platforms, or other types that aim to equal "Steel-Bound" design. *There is only one "Steel-Bound" Platform—and it is made by Stuebing. It was originated by Stuebing to bear loads carried by Stuebing Lift Trucks. It is fully patented!*

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LIFT TRUCK SYSTEMS

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(*Continued from page 39*)

their own shop. In each instance, the use of such a skid has been found successful, even on heavy loads.

In building a super-structure for carrying special parts, or in designing special skids, the lower platform and legs should not be changed, but should be standard equipment, and the super-structure should be in the form of an attachment, so that in case of necessity, it can be removed without damaging the entire skid. This method also permits replacement at a small expense, in case the lower part of the skid is damaged when in operation.

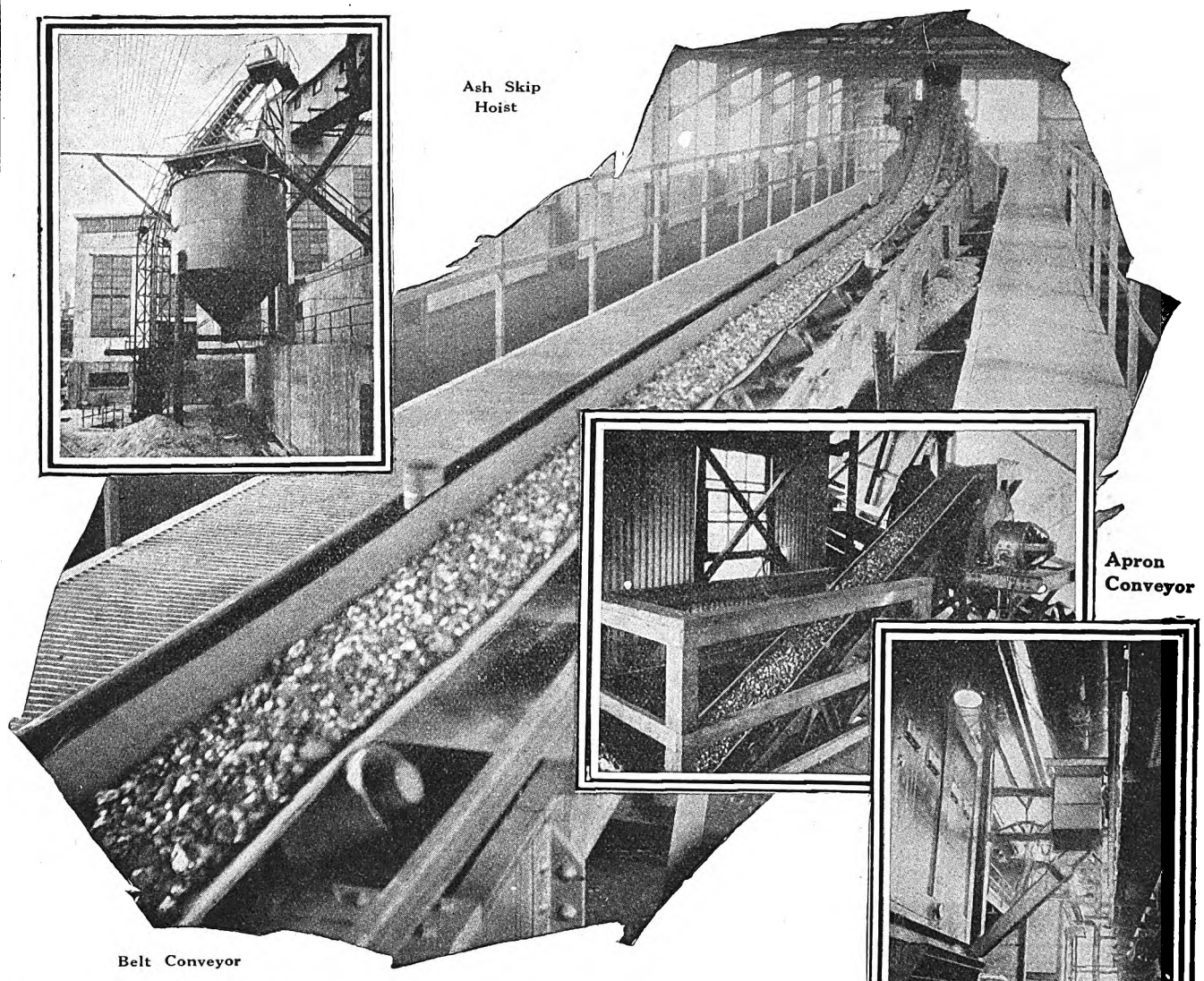
Figure 8 shows pressed steel skids, and this construction is becoming more common due to the practical indestructibility of this type. At the present time, they are being used mainly in heavy machine work, but as the advantage of low maintenance costs is being realized, they are slowly being put in other industries, and on operations where lighter skids are now being used. It is a simple matter to equip these skids with special super-structure, the same as the steel and wood construction skids are equipped with special super-structures for handling various kinds of materials.

It will be seen from the illustrations that it is possible to develop a skid for practically every material, and for every industry, and these are only a few of the many types that are now operating successfully.

Some machine operations, as shown in figures 18 and 19, make special provision for holding the skids so that the material can be loaded direct from the machine to the skid without the necessity of re-handling. It is a well-known fact that the paper industry caused the development of the platform lift truck idea of transportation, and it is therefore interesting to note that this ingenious device shows the way of handling finished paper on skids direct from the finishing machine.

The secret of a successful installation is few trucks and many skids. The plant manager who tries to lessen the number of skids, is only reducing the efficiency of his system. Lift trucks whether hand, electric or gasoline, cost considerably more than old type hand trucks, and for this reason should be kept continually busy. In the majority of cases, the complete system should include both power-driven and hand-propelled trucks so that the long hauls can be carried rapidly by power, and the short hauls by hand trucks. If there are a number of short hauls, it is frequently more advantageous to install a power-driven truck than several hand trucks, the reason being that although the initial expense is higher for the power-driven truck, it will reduce the number of men required if hand trucks were used.

The use of skids and elevating trucks will mean a change in handling methods, and executives should not expect this equipment to operate under the same methods employed when platform hand trucks were used.



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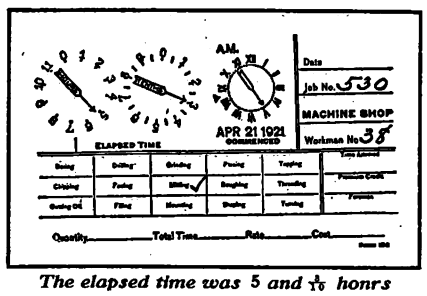
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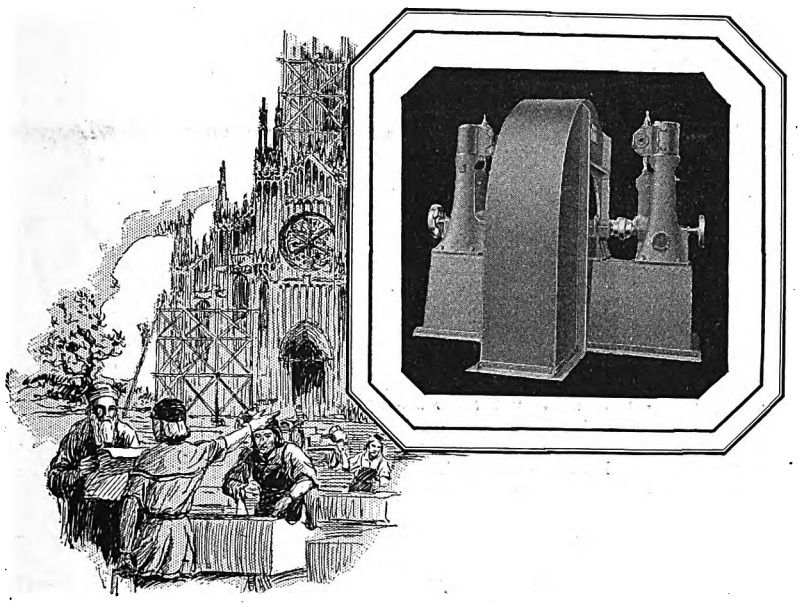
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Clarage Fans are built in types and sizes for every service.

Cost Accounting in the Lumber Industry

(*Continued from page 17*)

phases of the system is that it would have cost these 250 millmen from $500 to several thousand dollars each to have such a system devised and installed. The Association, however, furnishes it without charge to its members, and sells it complete to non-members for $25.00, also providing the required stationery at cost. The saving in accounting fees alone has amounted to over one hundred thousand dollars, while the indirect savings effected by the uniform and accurate methods adopted as a result of the cost system, amount to many times that figure.

The millman of the early 90's was usually a broad, powerful, hardhitting lumberjack. Saving a few hundred dollars from the annual sprees where most of the "piles" were dropped, he invested in a second-hand sawmill, obtained some timber-cutting rights, or stumpage, and literally "hung up his shingle." From the earliest days, the decay-resistant red cedar furnished an important source of revenue.

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With the coming of the small town, he moved his limited surplus to the bank. If some week a forgotten note came due, he grabbed a few bills from the rough fir desk, hied himself to the bank, and was tided over the crisis. But the day came when even bills of lading did not bring the necessary cash. Then came the income tax man, with his skeptical eyes on the ink-stained returns of "Big Bill."

(*Continued on page 45*)

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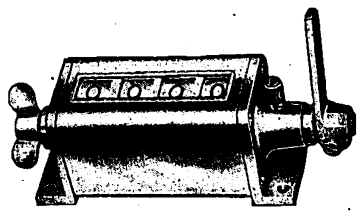
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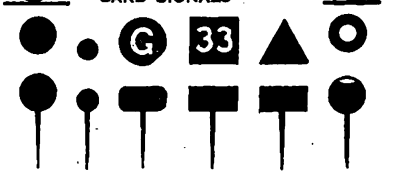
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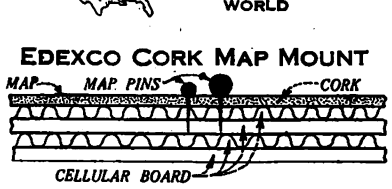


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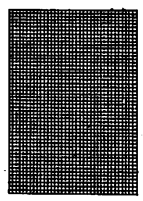
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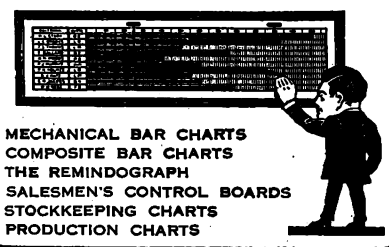
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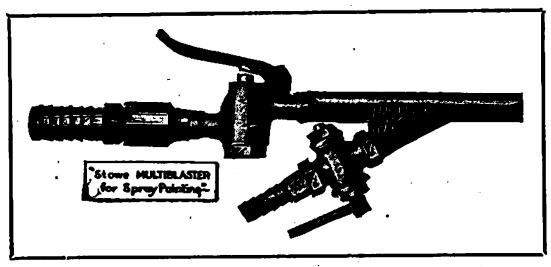
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May we send you via Parcels Post a Multiblaster on 10 days' trial? Ready for instant attachment to your air-lines—paint syphoned from any convenient container — **Price $12.00**, F. O. B., BUFFALO. Shipping weight 3 lbs. Requires 40-50 lbs., air pressure.



"The Man Behind the Gun"
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Geo. M. Stowe, Jr. Manufacturer

68 Forest Ave., Buffalo, New York

Makers also of Stowe Multiblasters for Sand Blasting

Multiblaster for Mechanical Application of Paint

DIAGRAPH YOUR SHIPMENTS

The Diagraph cuts legible address stencils for marking all packages, boxes, bags, cans crates, castings and similar material. Addresses do not blur, wash or rub off. Safer than tags. A practical insurance against lost and delayed shipments.

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Branches in all principal cities. See phone books.



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(Continued from page 43)

Hard times, low prices, and lower demand, have gradually eliminated most of the "Big Bill" type of millmen. Those who weathered the storms did so by studying their operations, eliminating wastes, and above all else, recording the facts concerning their business. The despised "figgers" are often today the direct means of converting the banker's "NO!" into a less emphatic but more relieving "Yes!" And not infrequently that has been the difference between closing down or "turning over."

Then, too, the larger operators came into the field, and with modern machinery for handling and milling, set lumber prices which the less productive could not meet. Ability to keep operating and meet bills, even in "hard times," is a powerful argument, and millmen have come to respect the ledgers and journals studied so intently by the banker.

It required a World War, however, to bring home the pressing need of a cost accounting system. With wages skyrocketing, prices more or less reluctantly following, and costs completely demoralized, the millman had to have some means of finding quickly whether the "big foreign order just received" meant a new lease of life, or merely a receiver's sign on the office door.

The mills vary in quantity of lumber cut, from 10,000 feet board measure, up to 500,000, or more, per day. The cost problem for mlls of 50,000 capacity and up, is largely the same. For such mills, accounting and engineering service for installing an accurate, simple yet adequate cost system, would rarely be less than $500. At that price, few mills prior to the war had the knowledge of their costs which the times demanded. However, western manufacturers learn rapidly; the lessons of economy taught in the school of coöperation are being applied as never before.

Stabilization of the industry in this section inevitably leads to lower lumber prices. Even today the western mills go directly into the territory of other lumber producing regions and undersell many of their competitors. But there is a reasonable lower limit of prices. If Bill Stevens, down at Kelso, Washington, unwittingly sells his output for ten per cent. less than it costs him, it is decidedly troublesome for everybody, until the banker or the receiver steps in.

The Association's Committee on Cost Accounting was composed of experts: four practical lumbermen, three certified public accountants, and an industrial cost engineer, all of whom were experienced in lumber accounting. Such an array of "figuring" talent was never before assembled in the West. For eight months this committee studied every angle of lumber costs, from the scaled "log feet" in the lofty evergreen to the 75 or more items of the sawmill: the boards, plank, flooring, lath, shingles and other finished product. When work was completed the cost was approximately $15,000; but the committee had designed a system which will endure as long as trees are felled in this country. Even in the Pacific Northwest, this will be a long time

(Continued on page 48)



A Shadowless Factory

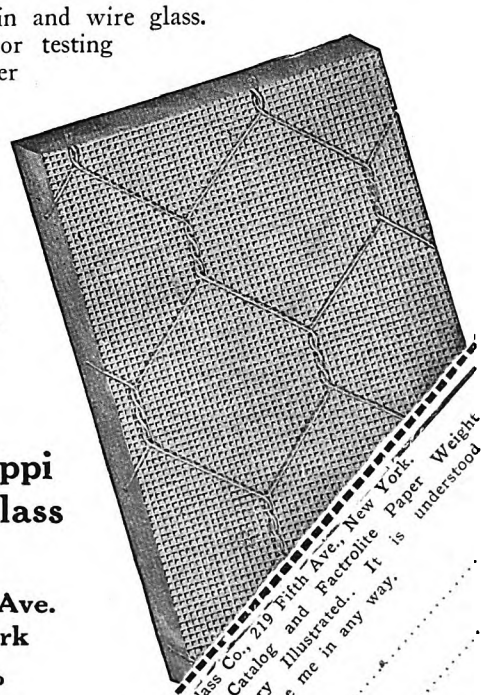
A big Government building 700 x 300 ft. was recently daylighted by over 100,000 sq.ft. of "FACTROLITE." In commenting upon the quality of the daylight *diffusion* in the big structure, engineers remarked—"You cannot see a shadow in any part of the building."

This perfect *diffusion* is a characteristic of "FACTROLITE," which was scientifically determined before we started to manufacture it. Every square inch of "FACTROLITE glass" is covered with 900 minute pyramids, each with a rounded apex and rounded fillets between.

They gather light from a wide angle and deflect it indoors —perfectly diffused. The result is that greater lighting *power* is attained, especially on dull days—and the direct glare of the sun never interferes with work. Freedom from shadows is a third result and an important one, where fine mechanical precision is required.

FACTROLITE

is made in both plain and wire glass. A sample suitable for testing or use as a paper weight will be sent to industrial engineers on request.



This coupon will bring it at once.

Mississippi Wire Glass Co.

219 Fifth Ave.
New York

Chicago
St. Louis

Gentlemen: Send me a Catalog and Factrolite Paper Weight as advertised in Industry Illustrated. It is understood this does not obligate me in any way.

Name .....

Address .....

When writing advertisers please mention Industry Illustrated

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Clean Drinks Pure Drinks Cheap Drinks

Ah-h-h!

That's a good drink!

An exclamation that means increased production in *any* plant during the summer season.

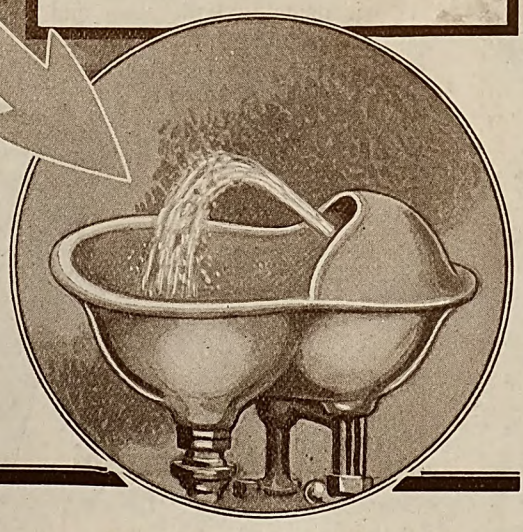
Whether steel mill or canning factory—clothing mill or machine shop—EBCO Sanitary Fountains will make for a better day's work from your employees.

Place EBCO Fountains in convenient locations throughout the plant and put another prod in production.

EBCO Fountains are substantially built, inexpensive in first cost and economical in the use of ice.

May we send you a catalog?

The Angle Stream is your protection against sickness and epidemic. No water can fall back into the jet spout to carry germs, and transmit them to the next drinkers.



The D. A. Ebinger Sanitary Mfg. Co.

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ROOT COUNTERS touch upon 4 Questions of Vital Importance to Every Industry

What is an Automatic Counter

It is the one dependable instrument that permits no variation between estimated and actual production cost.

Why Use them

Because business demands the accurate facts they count.

What Will they Count

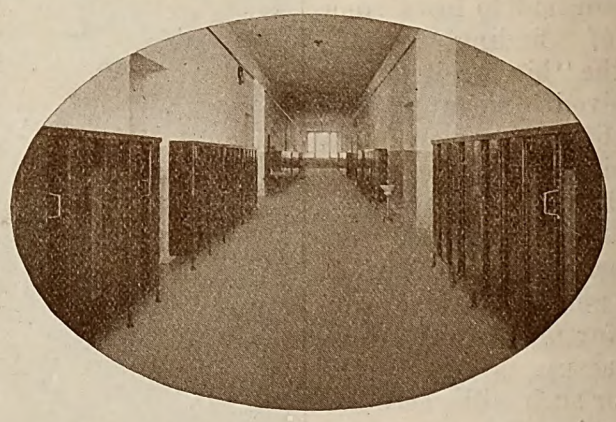
They count everything and any thing.

In Which Industries Can they be Used

In any and every industry

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BRISTOL, CONN.

May we send our catalog?



A Good Flooring

There are many reasons why Marbleloid *Permanent* Flooring is used extensively in Industrial buildings for Offices, Laboratories, Hospitals, Restaurant, Cafeterias, Welfare Rooms, Workrooms, Toilet and Locker Rooms, Display Rooms, etc.

It is fireproof, resilient, non-abrasive, non-slipping. Does not require expensive upkeep and can be laid upon old or new wood or concrete floors. It is a standardized lightweight composition flooring, manufactured and installed by our organization and guaranteed without restriction by us. Laid plastic, it sets in a few hours into a seamless, smooth surfaced floor, good for a lifetime of service.

The Coupon below will bring you the detailed advantages and cost of installing Marbleloid Floors in your new building or for resurfacing your old floor.

MARBLELOID
The Universal FLOORING for Modern Buildings

THE MARBLELOID COMPANY, 467 Eighth Ave., New York

THE MARBLELOID COMPANY, New York City: Without obligating myself in any way, please submit tentative estimates on the cost of your product installed complete for our building_____; below are the approximate areas involved.

Floor_____Sq. Ft. Sanitary Base_____

Lineal Ft. Wainscot_____Sq. Ft. I have checked the floor troubles we now have.

Our floors are

☐ New Concrete ☐ Cement Finish ☐ Wood
☐ Cracking ☐ Cold ☐ Slippery
☐ Dusting ☐ Splintering ☐ Unsanitary
☐ Noisy ☐ Rough ☐ Rotting

Name_____

Firm_____

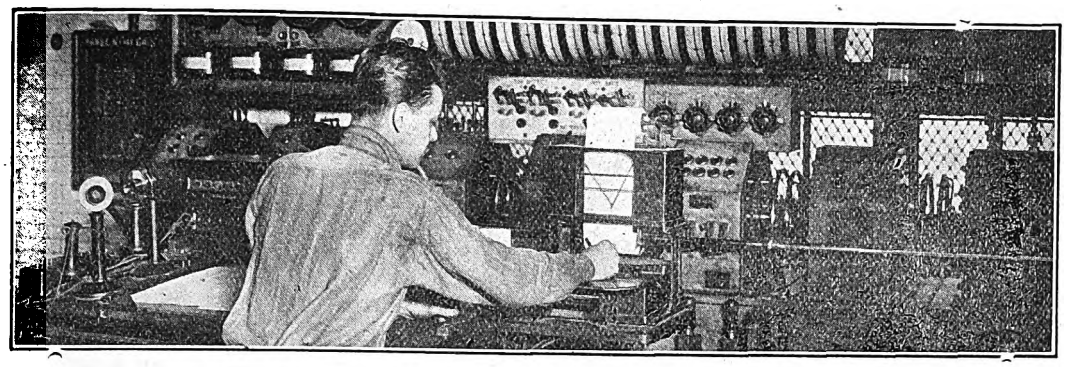
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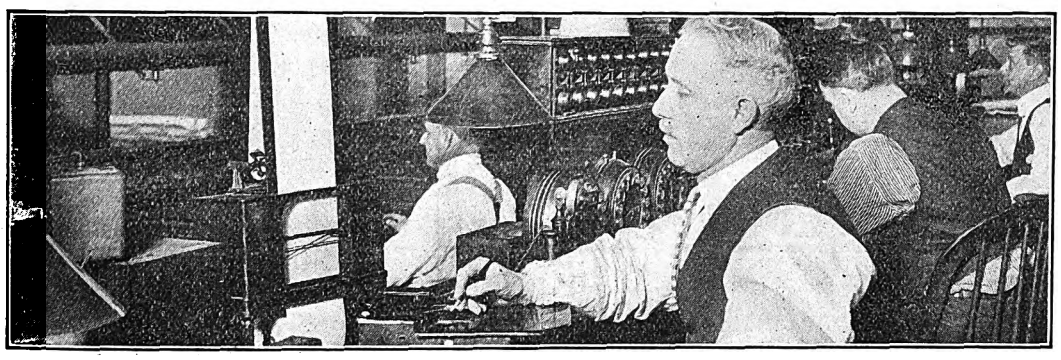
HANDWRITING BY WIRE — FIXING RESPONSIBILITY



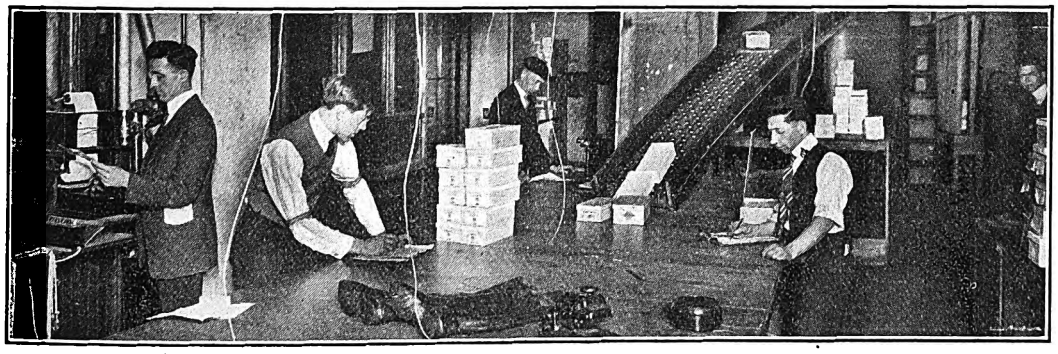
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Burns Bros. Coal Co.—New York Telautographing orders to yards.



Pennsylvania Railroad Telautographing Train Reports to Depot.



Morse & Rogers Shoe Co. —New York Telautographing "Short" orders.



N. Y. 'Quinine & Chemical Co. Telautographing Warehouse orders.

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Branch Offices 30 Cities
Service Supplied in 108 Cities

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(*Continued from page 48*)

mills in the negotiation of property sales, the negotiation of credit, the adjustment of fire losses, and the safeguarding against financial loss through clerical mistakes or through fraud."

The use of the system, forms and entries, is fully explained in the Manual, enabling each concern to adapt it easily and quickly to its needs.

The Manual is divided into fifteen main sections, briefly described as follows:

1. *Statements,* comprising Condensed Comparative Balance Sheet, monthly; Condensed Operating Statement; Detailed Operating Statement, Logging and Mfg. Costs; Ditto, Cost of Sales, and By Products; Ditto, Distribution of Overhead Items.

2. *Forms,* consisting of Cash Receipts; Settlement Journal (Accts. Receivable, etc.); Bank Check Register; Journal; Voucher Register; Sales Record; Sales Journal; Sales Analysis; Lumber Record; Voucher Distribution Record; Journal Voucher Form; Insurance Register; Prepaid Supplies and Expenses Register; Ledger; Pay Roll; Camp Time Sheet; Mill Time Sheet; These Forms are all shown in detail.

3. Chart of Accounts: List of the 158 major accounts, under main headings of Assets, Liabilities; Capital; Revenues; Purchase; Operating Costs & Expenses; Logging; Manufacturing; Selling Expenses; Administrative Expenses.

4 to 12, inclusive: Detailed Analyses of Items Summarized in (3), explanation of each account, purpose, and all credits and debits to be made.

4. Assets: Petty Cash Fund; Cash Undeposited; Bank ; Accts. Rec.; Notes and Acceptances Rec.; Ditto endorsed; Inventories; Inv. Stock of Supplies; Camp Wood; Investments U. S. Lib. Bonds; Inv. Stocks and Bonds; Real Est. Non-Oper.; Sinking Fund; Timber & Timber Land; Real Est. Mill Site; Real Est. Town Site & Other; Mfg. Plant, Bldgs; Mfg. Plant, Equipment; Logging Equipment; Railroad; Furn. & Fixtures; Stock in Sub. Cos.; Unexpired Insurance Premiums; Prepaid Supplies and Expenses; Temp Spurs;

5. Liabilities: Pay Roll; Time Orders Payable; Commissions Payable; Vouchers Payable; Accounts Payable; Notes and Acceptances Payable; Accrued Interest; Collateral Notes Payable; Notes and Acceptances Endorsed; Unredeemed Coupons; Accrued Taxes; Reserve for Bad and Doubtful Accounts and Notes; Reserve for Anticipated Accounts; Reserve for Freight; Reserve for Depreciation; Reserve for Anticipated Repairs; Reserve for Shut Down Overhead; Mortgage Bonds;

6. Capital: Capital Stock; Surplus; Surplus, Timber and Timber Lands Appreciation; Profit and Loss;

7. Revenues: Logs Sawn, Saw Mill; Logs Sawn; Shingle Mill; Logs, to Others; Logs Lost and Used; Sales, Lumber; Allowances; Underweights (with Illustrative Entries); Lath; Wood and Sawdust; Box Shooks; Cut Up Factory; Shingles; Lumber Sales, Direct Shipments; Store Merchandise; Camp Commissary; Hotel; Mill Mess

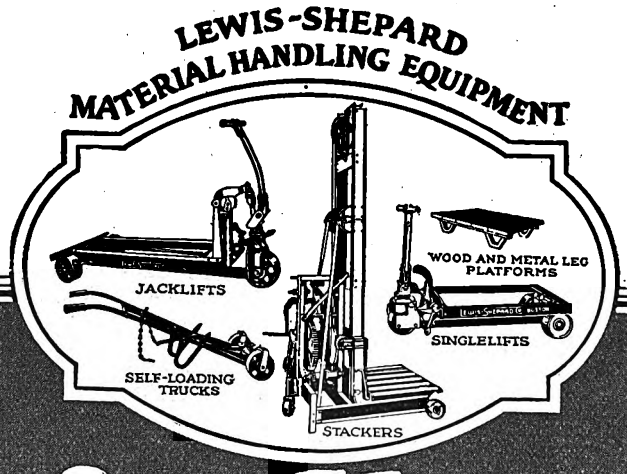
Over 600% Profit in one year

This experience of 24 average customers strengthens our conviction that Lewis-Shepard Jacklifts, Stackers and Platforms cut down the cost of labor and increase operating efficiency more than any other labor-saving product on the market.

The service of our experienced Sales Engineers is yours for the asking. Just write,—and we will gladly have one call. Without obligation on your part he will show you how to improve your material handling methods and *save men and money* with Lewis-Shepard Equipment.

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Branches in 22 Principal Cities

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House; Camp Mess House; Camp Bunk Houses; Barn; Power, Light and Water; Rentals; Floating Equipment; Outside Service; Stumpage, Profit and Loss; Sundry Income; Discount Taken; Interest Received;

8. Purchases: Logs Sawn; Logs Purchased; Lath; Lumber to Box Factory; Lumber to Cut-up Factory; Shingle Mill, Logs; Shingles Purchased; Lumber Purchased, Mill; Lumber Purchased, Direct Shipments;

9. Controls: Labor; Supplies; Expense; Repairs; Power, Light and Water; Blacksmith and Machine Shop, Mill; Ditto, Camp; Selling, Administrative;

Operating Accounts, not recorded in General Ledger, but kept on Form 6; Distribution of Operating Accounts;

10. Logging Costs: Contract Logging; Rigging Ahead; Falling and Bucking; Yarding and Loading; Wire Roper; Depreciation, logging; Railroad; Spur Tracks; Water Haul; Other Haul; Booming and Rafting; Boom Stick Towing; Depreciation, Transportation; Salaries and Wages; Sundry Expenses; Anticipated Repairs; Shut Down Overhead; Logs Lost; Stumpage;

11. Manufacturing Costs: Pond or Log Yard; Saw Mill; Sorting Table; Dry Kiln; Timber Dock; Transportation; Piling; Rough Dry Shed; Dry Sorting; Finished Shed; General Planing Mill; Sizer; Depreciation; Salaries and Wages Sundry Expenses; Anticipated Repairs; Shut Down Overhead;

12. Miscellaneous Costs; Lath; Wood; Box Factory; Cut Up Factory; Shingle Mill; Shipping;

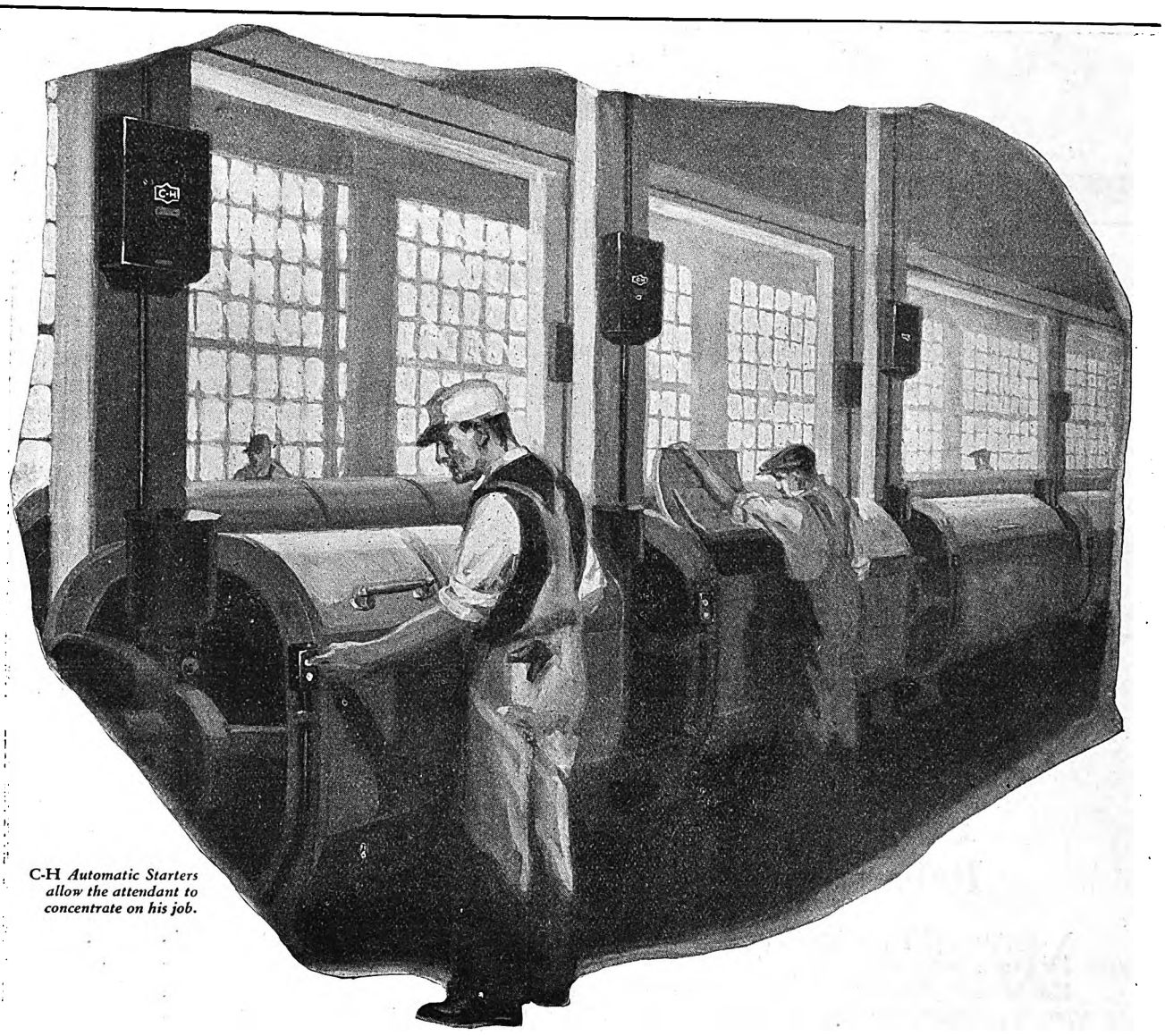
13. Selling and Administrative Costs: Selling; Branch Expenses; Salaries; Supplies; Rent, etc.; Professional Expenses; Interest, Taxes, Discount, etc.

14. Explanation of Forms: Form 1, Cash Receipts and Settlement Journal; Form 2, Check Register; Form 3, Journal and oucher Register; Form 4, Sales Journal; Form 5, Sales Analysis; Form 6, Distribution; Form 7, Journal Voucher; Form 8, Insurance Register; Form 9, Prepaid Supplies and Expenses Register; Forms 10A, 10B, 10C, Accounts Receivable; Form 15, Pay Roll; Forms 16A and 16B, Time Sheets;

15. Explanation of Statements: Monthly Report; Detailed Operating Statements, three; Condensed Operating Statement; Methods of Determining Production and Sales;

Study of these headings and the Manual reveals the completeness of the record for all logs used, cost, disposition and revenues; also the detailed record of each one of the 62 operations involved in converting the tree into wood products. It is surprising to find that 75 different products are regularly manufactured by the average mill, though some are equipped for some of these products only.

When the modern millman turns to his statement at the end of each month, he knows exactly what his mill has accomplished; what kind of lumber was milled; what was sold; what it cost him; and what the net returns were. Also, what per cent. he realized on his in-



C-H *Automatic Starters allow the attendant to concentrate on his job.*

Increased Production Through Eliminating Delays

Cutler-Hammer engineers have for over a quarter-of-a-century specialized in designing and applying control apparatus to improve motor driven machinery production.

In many cases the substitution of automatic controllers increases production by relieving workmen; by pre-selecting proper speeds; by reducing annoying and costly delays due to fuse blowouts and motor burnouts.

The safety type Starter shown above is entirely enclosed, mounted out of the way, with start and stop station located within easy reach of the workman. In place of fuses, this Starter has Mercury Overloads which permit a better starting current for the motors, and protect the motor windings against overheating and burning out. They reset automatically after an overload trips them.

Cutler-Hammer engineers may be able to help you increase production with your present plant capacity by improving the motor drives and control.

THE CUTLER-HAMMER MFG. CO.
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C-H CUTLER-HAMMER **AUTOMATIC STARTERS**
BULLETIN 9604 WITH MERCURY OVERLOAD RELAYS

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vestment (if any) and whether it will pay to run the mill next month on full, half time, or no time at all. *He knows where he stands;* and it is said there is no feeling in the world quite so satisfying as knowing just where one's feet have led him, and toward what goal he is heading. For if it is the wrong goal, there's always another road leading away from it.

Even more important, his records show the "dead line" below which no sane man will operate for any length of time. This line varies, of course, with the location and costs of doing business, but it is fundamentally important to know where one's own limit lies.

Detection and elimination of leakages, with the inevitable result of lower prices, is another practical advantage of this system. It is, of course, the prime object and justification of cost accounting.

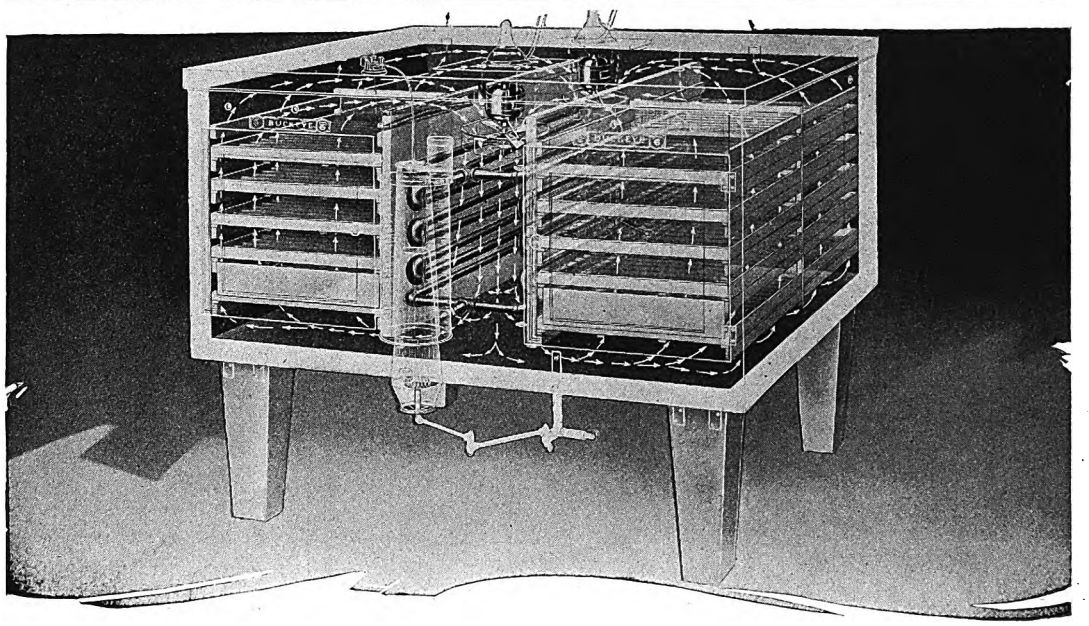
For the sixty-odd mills which make regular monthly reports to the offices of the West Coast Lumbermen's Association, there is the further opportunity of comparing their individual operations with the other reporting mills. A monthly analysis of Douglas Fir Costs and Sales Returns is issued to each of these reporting mills, showing a Condensed Operating Statment summarizing the operations, actual operating gain or loss for the group, and itemizing the operations by feet of lumber cut, amounts received, and final percentage return on invested capital for the entire group, both for the current month and for the preceding calendar months of the year. Thus the millman can compare his operations with those of the group, and with the average of all reporting.

There is also a report summarizing the financial operations of each mill; by an ingenious system of numbering each mill, determined by the relative cost-standing, each millman can obtain financial statement of operations for all the others, in code, compare his own standing by knowing his own report, but is unable to identify the other reports. Thus no unfair advantage can be taken of the reports, yet each millman can find his own report, analyze and compare his own operations with the others in the group. No information is ever given out except through these disguised reports.

The system is doing so much to stabilize the lumbering industry in the Pacific Northwest that it may rightly be considered one of the most far-reaching improvements devised by any industry in the country. Every person in the United States is vitally interested in these methods of bringing lower lumber prices, for each one daily eats, sleeps, works and moves over and in contact with wood products. The high cost of being surrounded and supplied with the product of the forest primeval is being slowly but surely reduced.

The total number of employees on the payroll in 1428 representative U. S. factories at 2,041,000 on June 30th, compared with 2,048,000 on May 31st and 1,722,000 on June 30th, 1922. The total amount of involuntary unemployment in Pennsylvania on July 1 amounted to 8,957 as against 9,465 on June 1 and 124,665 on July 1, 1922.

SKF



10,000 Lives at Stake

Reliance Placed in Ball-Bearing Fans

MAMMOTH incubators of this type are built with a capacity of over 10,000 eggs. The hatching of the maximum number of large, healthy, strong chicks from these eggs is dependent upon maintaining an equal distribution of heat throughout the egg chamber and upon continuous uniform ventilation. Failure to maintain the proper temperature and to remove poisonous gases as formed not only reduces the quality but also the quantity of the hatch.

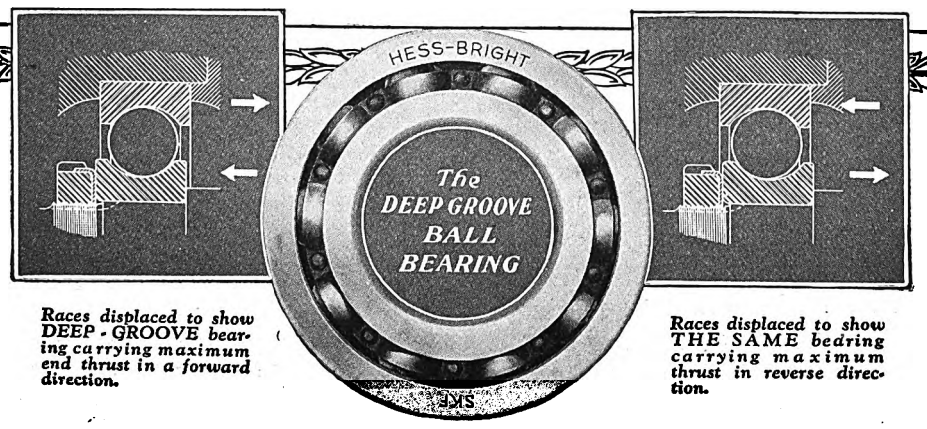
Reliance is placed in electric fans equipped with deep-groove ball bearings made by the Hess-Bright Manufacturing Company to maintain an equal distribution of heat and to remove the poisonous gases. These fans are kept in continuous 24-hour a day operation for a period of five months and are giving complete satisfaction to thousands of users.

Whether your bearing problems lie in the field of industry, transportation or science, ball bearings will give that reliability of performance and precision of operation which you seek.

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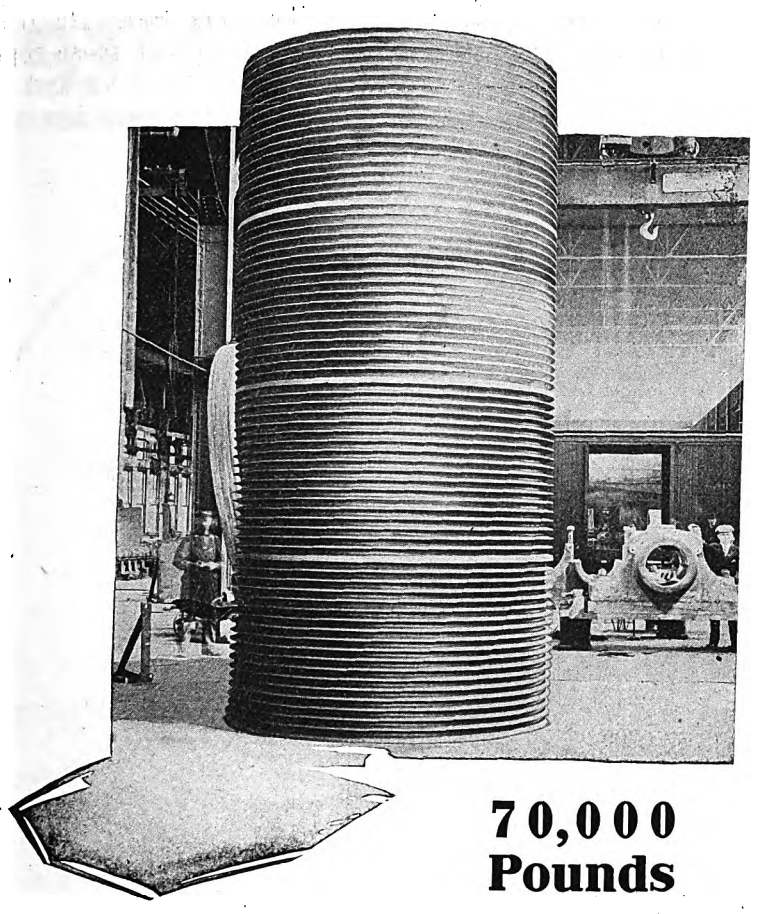


BALL BEARINGS
The Highest Expression of the Bearing Principle

Races displaced to show DEEP-GROOVE bearing carrying maximum end thrust in a forward direction.

Races displaced to show THE SAME bearing carrying maximum thrust in reverse direction.

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70,000 Pounds

There is no power transmission problem too big for Dodge

THIS immense sheave built up in six sections with a face measurement of 107 inches and a total weight of 70,000 pounds is only a small part of the Dodge built equipment in one of the largest glass factories in this country.

Similar installations of gigantic power harness have been furnished by Dodge for practically every industry. Rolling mills, paper mills, cement plants, coal and metal mines have relied on Dodge for power transmission equipment for over forty years.

The supplying of power transmitting equipment and unusual size and design is but a part of Dodge service to industry. The Dodge line includes everything for the mechanical distribution of power—carloads of stock pulleys, hangers, pillow blocks, etc., are available for shipment from our great central warehouses to our fourteen branches who in turn supply hundreds of local Dodge dealers.

Complete line shaft equipments assembled and tested before leaving our factory are designed and built under the supervision of engineers qualified by long experience in supplying the specific needs of the various industries served by Dodge.

You cannot afford to specify inferior transmission equipment—its efficiency has too great an influence on your profits. Make Dodge the standard in your plant—your judgment will be backed by the thousands of discriminating buyers in every industry who have profited by the continuous service, power savings and low upkeep characteristic of all Dodge installations.

Write for catalog—submit your problems for practical recommendations.

DODGE

Power Transmission Machinery

DODGE MANUFACTURING CORPORATION

General Offices: Mishawaka, Indiana. Works: Mishawaka, Indiana, and Oneida, N. Y

Dodge Manufacturing Company of Canada, Ltd., Toronto and Montreal

New York, Boston, Philadelphia, Pittsburgh, Atlanta, Minneapolis, Houston, Seattle, St. Louis, Chicago, San Francisco, Cincinnati

Personnel Work That Pays Dividends

(*Continued from page 19*)

the work of the medical director. Upgrading of morale and reduction of absenteeism have resulted.

Health and safety education is carried on consistently through demonstration and lecture courses independent of a well established safety committee. Lessons in First Aid, bulletins, distribution of literature, also form a part of this feature.

3. *Advisory Service:*—Considerable stress is laid on the ability of a specialized department such as this, to render aid and advice in legal and personal difficulties. The results and success of this activity may be inferred by increased demand for it.

4. *Plant Organs:*—With geographical and technical differences, two independent plant publications are maintained. These both take the form of small mimeographed sheets published frequently enough to hold interest and carrying real local news. The usual departments run in non-advertising house organs are found.

5. *Employee Activities:*—Mutual aid, athletics, social events are carried on with staff guidance from the Personnel Department. Inter-plant contests have been initiated and a keen interest manifested.

6. *Joint Relations:*—An employees' advisory committee has developed beyond the point of complaints and grievances to a real factor in the solution of problems common to both management and worker.

Through the recognition of sound personnel relationships, technical committees are operating harmoniously and effectively for the coöperation of departments. Considerable educational work is carried on through these committees.

With the aid of the Federal Board of Vocational Guidance courses of foreman instructor-training were recently carried through successfully.

(*Continued on page 55*)

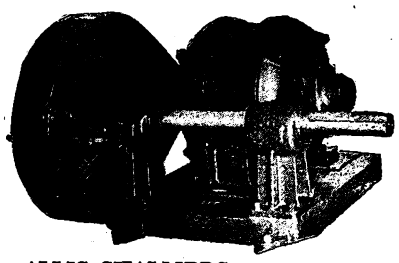
For that

Back Geared Motor

specify a

WATSON-FLAGG

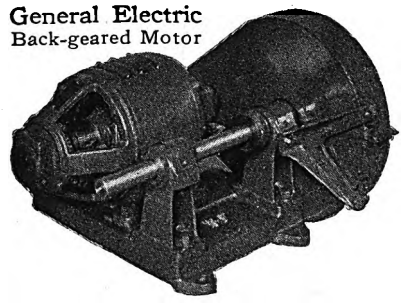
Reduction Gear Drive



ALLIS-CHALMERS
Back-geared Motor

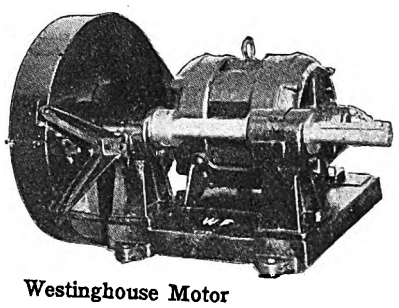
Furnished as Standard Equipment by the better Motor Manufacturers.

General Electric
Back-geared Motor



Watson-Flagg Reduction Gear Drives will fit ANY Standard Motor of Any Make.

Large stocks insure prompt shipment on receipt of motor at our works for mounting.



Westinghouse Motor
Equipped with **W-F**
Reduction Gear Drive

Ask Your Motor Manufacturer or

WATSON-FLAGG

ENGINEERING COMPANY
PATERSON, N.J.

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The best equipped plants have the best efficiencies

Steam Pressures are going up. So is the price of coal—

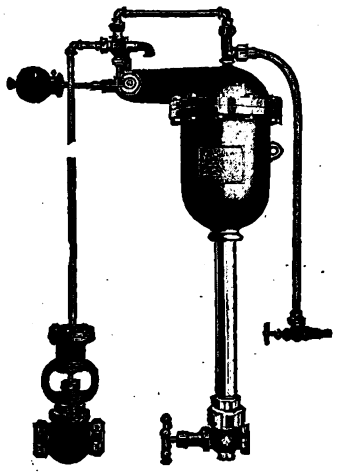
Two power plants, one in Boston —one in the West are going to 1200° and 1500° steam pressures. Fine, but the majority of plants will have to wait and see what happens.

Probably nothing spectacular will happen for these power plants expect higher operating costs as in the past with a probable increase in the price of coal.

But a larger number of power plants than ever before are paying strict attention to their water levels. Engineers are realizing more and more that it is impossible to obtain maximum economy and efficiency through hand regulation of boiler feeding. They are right. It does take automatic mechanical regulation for that.

And when it comes to a Feed Water Regulator, there is nothing like having an old reliable Vigilant on the job. They hold the water at a fixed point under all operating conditions and at all boiler loads. Their use insures drier steam, increased boiler capacity, greater fuel economy.

VIGILANT Feed Water Regulator



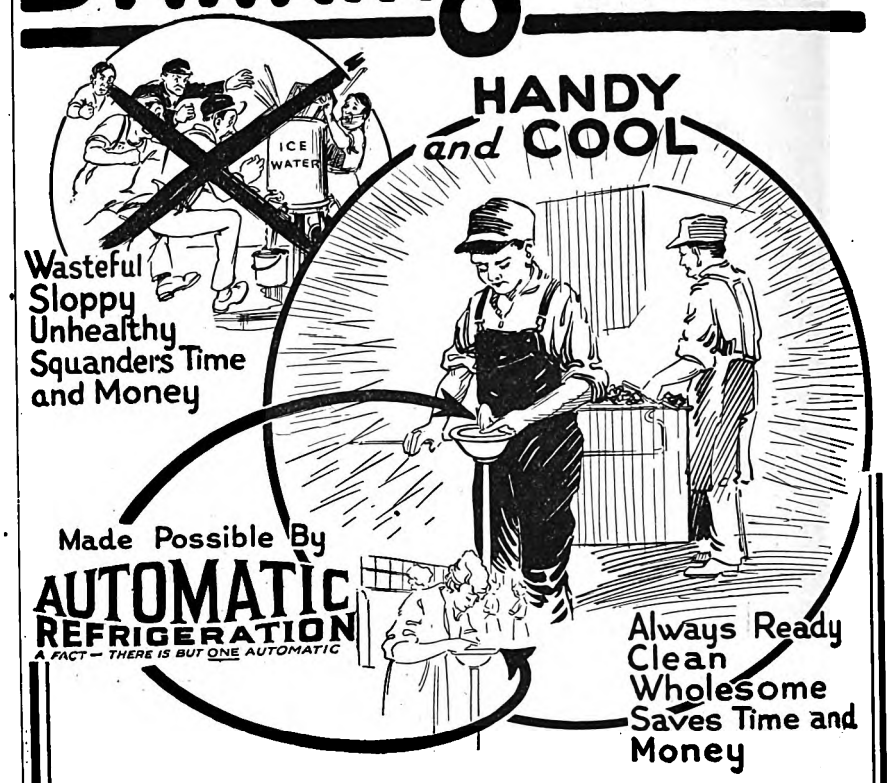
Get our engineers' recommendation. No Obligation.

Write for the catalog today.

The Chaplin Fulton Mfg. Co.,

28-36 Penn Avenue
Pittsburgh, Penna.

Drinking Water



Automatically Cooled Water Can Be Mighty Profitable to *Your Plant*

Icing drinking water coolers is a costly nuisance. It's sloppy, unsanitary, inadequate —objectionable to the management and employees alike.

One mill recently reported saving over *$25.00 each year* SINCE they installed their Automatic Refrigerating Plant.

Besides this marked saving of cooling water without the trouble of handling ice, they have noticed a great reduction of time lost from productive work. The handy bubblers are distributed about the plant and supply an abundant amount of drinking water at always an even temperature. Cases of cramps and other sickness due to improperly cooled water have been entirely eliminated. Electrically driven, Automatic Plants require no skilled operators and little or no attention. They operate themselves.

No progressive manufacturer can ignore the advantages and savings of Automatically cooled drinking water systems. The subject is treated in detail in literature which we will gladly mail upon request. Write for a copy of our latest booklet today.

A few of many well-known plants equipped with Automatic Refrigerating Systems:

Graton & Knight Mfg. Co. Worcester, Mass.
Bridgeport Brass Co., Bridgeport, Conn.
Kiefer-Stewart Co., Indianapolis, Ind.
National Acme Co., Windsor, Vt.
Royal Worcester Corset Co., Worcester, Mass.
Fuller Brush Co., Hartford, Conn.
Hendee Mfg. Co., Springfield, Mass.
P. & F. Corbin Div. American Hardware Corp., New Britain, Conn.
H. Fendrich, Evansville, Ind.
Riverside & Dam River Cotton Mills, Danville, Va.
Carnegie Steel Co., MacDonald Bar Mills, Youngstown, Ohio

The Automatic Refrigerating Co.

Home Office and Works: Hartford, Conn.

Automatic Service is Nation Wide.

Offices in Many Cities

TRADE MARK
Reg. U.S. Pat. Off.

"Like the Old Cold Spring"

How you can bring it into your plant →

TEAR OFF AND MAIL TODAY

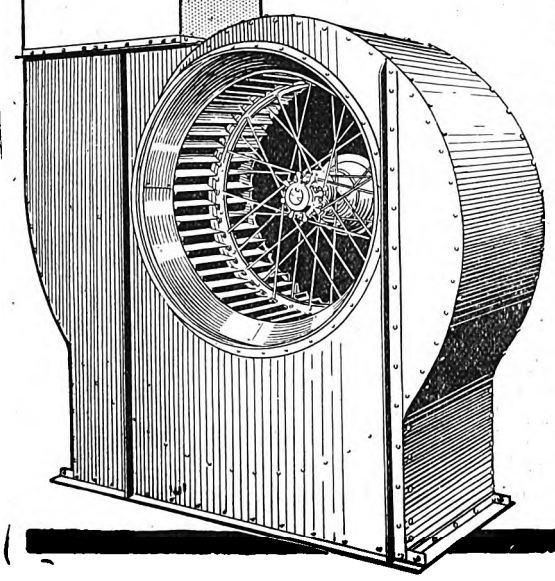
To The Automatic Refrigerator Co., Hartford, Conn.
Please send me your latest catalog without obligation.
Name .....
Firm's Name .....
No. of Employees .....
Position .....
Street .....
City .....
State .....

EFFICIENT VENTILATION

Can be obtained only through the use of equipment designed to meet the specific requirements for which it is intended.

Bayley PLEXIFORM FANS

are made in a variety of capacities from 300 to 300,000 cubic feet per minute. They are designed especially with a view of handling a maximum volume of air from a minimum of space and power requirement. Their efficiency as proved by installations in thousands of the largest industrial, public school, theatre and office buildings, makes them prime favorites with architects, engineers and owners.



Write for Catalog

BAYLEY MFG. CO.

DEPT. (P)

MILWAUKEE, WIS.

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(Continued from page 53)

7. *Records and Analysis:*—The necessity of keeping accurate and informative records was recognized at the outset, as effective personnel work cannot be administered on "Hunch," but must be based on an intelligent interpretation of real FACTS.

As an aid to systematic collection of these facts the "Table of Routine and Reports" was devised. This acts as a tickler and simplifies the task of collecting and routing all Personnel Department forms, as it tabulates the functions, duties of individuals, and times for the performance of these duties.

Turning to an analysis of some of these records, let us refer to *Fig. 7,* which is a composite chart of turnover and number on pay roll for the years 1920, 1921, and 1922 in one of the plants of the central group.

The nature of the products calls for a class of worker which is largely influenced by the demands of seasonal industries, such as canning and agriculture. In the first half of 1920 the efforts of the Personnel Department had, of course, not been felt, turnover then being at its highest. In 1921 when deflation had set in, wage reductions were engineered by the Personnel Department and turnover held at a minimum, with the working force slightly reduced. During 1922, in the face of wage increases in several industries and with business returning to normal and a special demand in the building trades, turnover, although higher than in the previous year, was held down, the force being steadily augmented the while.

An interesting illustration of the value of figures as shown on this chart may be cited here. At the annual general sales convention in December, 1921 the fluctuations in the working force from week to week were displayed graphically with the result that a sales policy was immediately formulated which leveled out the peaks and automatically improved product, production and profit as well as stabilizing employment. The curve for 1922 is distorted upwards by the opening of a new department in July.

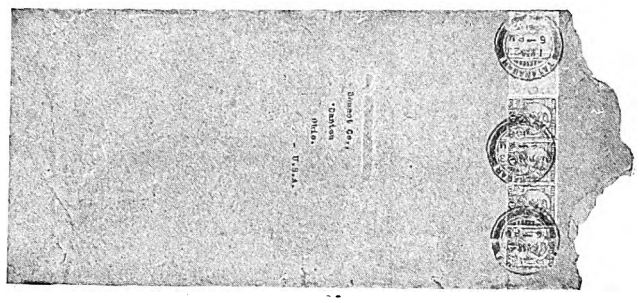
Analysis of the payroll on January 1st, 1923, shows that 13 per cent. had over five years' service, 35 per cent. over two years and 58 per cent. over one year.

The percentage of terminees in 1922 with one year's service was half that of 1921. This reflects the improved working conditions effected by the Personnel Department.

Similarly, information is obtained as to ages of employees and terminees. Twenty-four per cent. on January 1st, 1923, were between the ages of twenty and twenty-five, this being the highest percentage by groupings of five years. The highest number of terminees was also in this group (32 per cent.); which was also the highest group in 1921 (22 per cent.).

Annual comparison of employees and terminees is made by nationality and marital status in order to see that a proper balance is maintained. No disproportion has developed during the observed periods.

Accurate absentee records have been developed showing

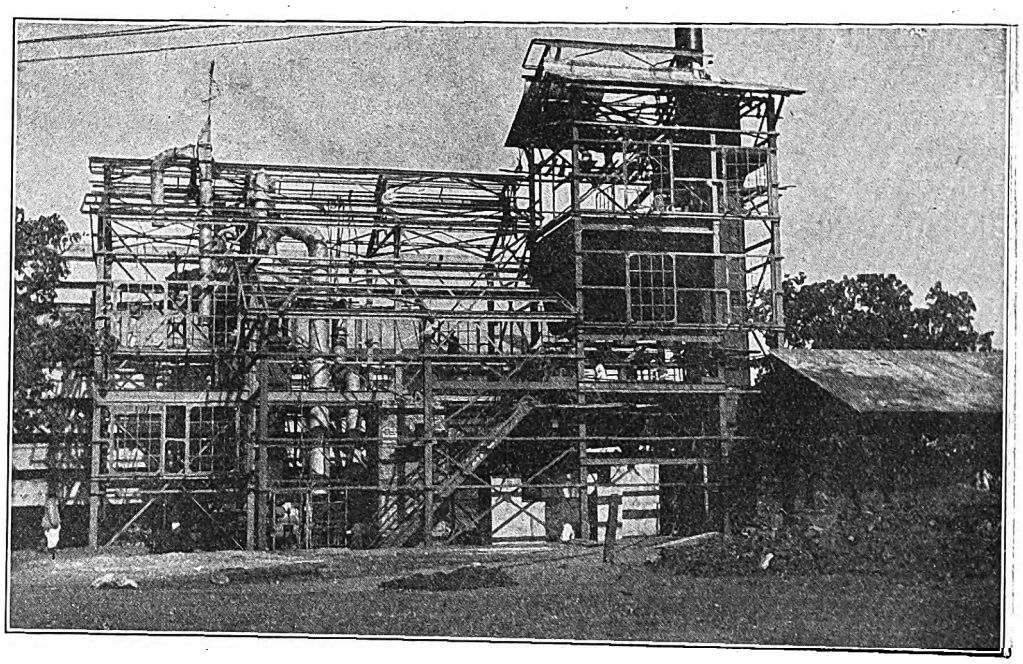


A Letter from India—

——— tells the marked success of the Holbeck Pulverized Coal System in the plant of the Agricultural Implement Company, Jamshedpur, INDIA.

This plant was the subject of a paper delivered by Mr. T. M. Dawson, Vice President, at the annual general meeting of the Institution of Engineers (INDIA) in January of this year.

The Plant



The Engineering Knowledge and Manufacturing Skill which can produce successful pulverized coal equipment for a company in India, thousands of miles away, is at your service -- in the United States.

Write for Bulletin No. 600

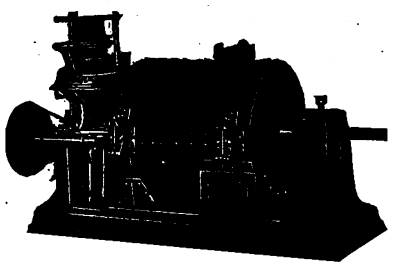
The Bonnot Company

CANTON, OHIO

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Pulverized Coal



The Aero Unit System

of Pulverized Coal again demonstrates, as in other work of human endeavor, how an original idea at first worked out by complicated and costly methods is finally simplified and perfected until it becomes a part of our every day existence.

The Unit System reduces the equipment and therefore the cost to a minimum by placing the Aero Pulverizer at the furnace where the coal is fed to the machine undried and is exhausted therefrom directly into the furnace. There are no dryers, no storage or long lines of transportation for the powdered coal, thus eliminating the hazard of fire or explosion.

Each Aero Pulverizer is designed as a complete powdered fuel unit for one furnace. They are built in standard sizes ranging from 600 lbs. to 5000 lbs. of coal per hour.

Bulletin Sent on Request

AERO PULVERIZER COMPANY

165 Broadway
New York

causes. These disclose an improvement wherever control is exercised. Lost time from

	1921	1922
(a) accident	.61%	.19%
(b) sickness	1.6 %	1.4 %
(c) personal reasons	.9 %	.6 %

Marked improvements have been made in the sanitary, hygienic and safety conditions of the plants, but it has been difficult to keep ahead of the general growth.

The justification of expanding the scope of this department was found by the successful experience with the first unit. The unique features of this plan are that all of the functions are directed from and responsible to, the central head office.

For photographs in this issue, not otherwise credited, we are indebted to the courtesy of the following:

FROM SCRAP AND PIG TO STEEL CASTINGS

The Detroit Steel Casting Co.

THE ELIMINATION OF RE-HANDLING

Lewis-Shepard Co.
Barrett-Cravens Co.
Yale & Towne Mfg. Co.
Cowan Truck Co.
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The Baker R & L Co.
Automatic Transportation Co.
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Stuebing Truck Co.
Clark Tructractor Co.
Youngstown Pressed Steel Co.

PERSONNEL WORK THAT PAYS DIVIDENDS

The Paraffine Companies, Inc.

SOLVING THE "IMPOSSIBLE"

Link-Belt Co.
Jeffrey Mfg. Co.
Palmer-Bee Co.
The Dow Co.

CUTTING THE EXCESS COST OF COAL

R. H. Beaumont Co.
Link-Belt Co.
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Shepard Electric Crane & Hoist Co.
Brown Hoisting Machinery Co.
Universal Crane Co.
The Elwell-Parker Electric Co.
The Browning Co.
The Barber-Foster Engineering Co.

HERE IT IS

New Catalog Showing How to Reduce Blue Printing Costs 50%



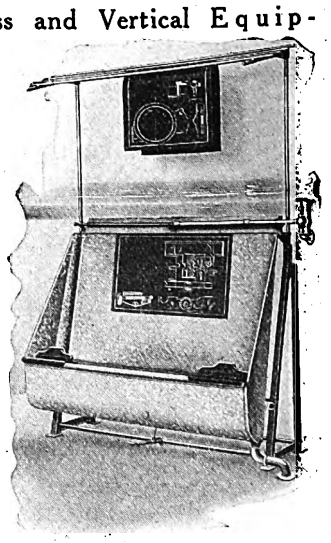
Illustrates and describes in detail the Pease method of making blue prints—shows how maintenance expense can be reduced to a minimum—proves that blue printing costs, on the average, can be cut 50%.

The Pease-Vertical and the Pease Peerless Machines have been decided on as the best of their type by the engineer and commercial blue printer—the men who know. The fact that there are more Pease machines in use than all others combined proves this.

The saving in actual expense is only part of the story told in Catalog M-23—blue prints can be made, with the Pease method, almost instantaneously, removing many costly delays in planning and production.

In the case of both the Peerless and Vertical Equipments, the printer may be purchased separately if desired. However, the complete equipment, in each case, provides, far the, by most economical combination for turning out blue prints.

Pease Blue Printing Machines are so simply constructed that any intelligent boy or girl can run one and divert his or her spare time to other duties. This is an exceedingly important point today, when ordinary labor is scarce and high priced.



This Washer together with the Pease-Vertical and Pease Sheet Dryer form a very economical method of turning out a steady supply of perfect prints.

Write for Catalog M-19

THE C. F. PEASE COMPANY

819 N. Franklin St., Chicago, Ill.

PEASE CHICAGO

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Cutting the Excess Cost of Coal

(*Continued from page 26*)

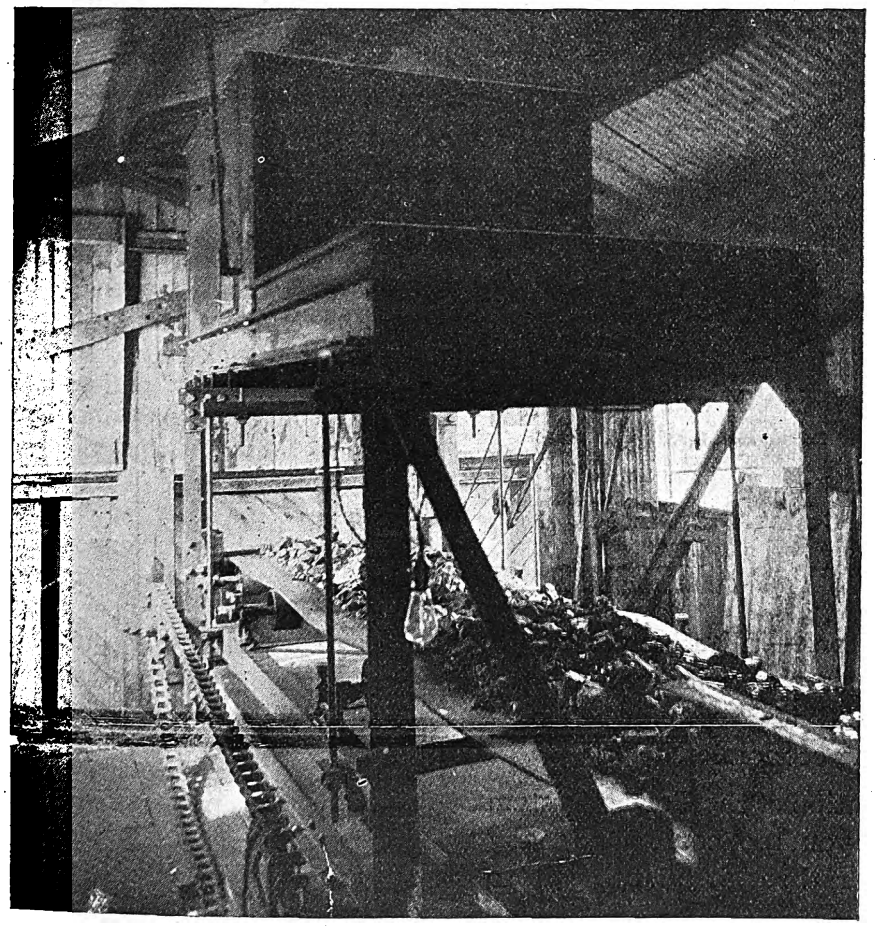
eventually ignite the pile. By no means should these pipes be left open at the bottom. The supposed ventilation thus secured is in reality an excellent chimney draft and aids, rather than prevents, combustion.

Bunkers and bins within the boiler house should also be divided up into compartments, so that any fire starting in one compartment may be segregated.

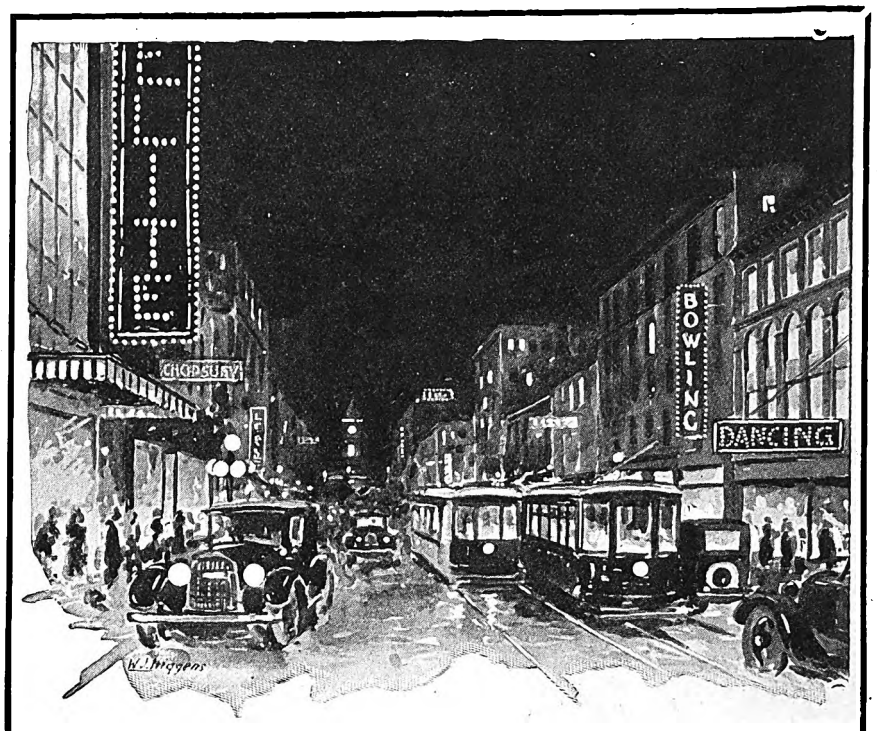
Exposed coal piles are not good, for several reasons. They are subject to alternate wetting and drying from the summer rains and winter snows. They are also subject to freezing and thawing. Thus the coal lumps are gradually broken apart, exposing fresh surfaces for oxidation. The result is two-fold. First, there is a slow depreciation in the heat value of the coal itself, especially with bituminous coal. Second, if the coal is subject to spontaneous combustion, these conditions tend to make the process a little more rapid. The oxidation and deterioration in exposed coal piles is more rapid in summer than in winter weather.

Coal is delivered to the boiler house, either direct from the railroad cars, barges or trucks, or from the storage pile itself. In hand-fired plants a part of the firing floor must be reserved as an inside coal reserve. Many such plants have replaced the old-time wheelbarrow by electrical industrial trucks or other more efficient means of handling. Where the hauling distance is greater than 100 feet and the quantity of coal burned exceeds 20 tons a day, the installation of an automatic conveyor system is often justified. No fixed rule can be laid down, however, and the economy of an automatic system of some kind will depend upon the particular conditions at each individual plant.

Overhead bunkers are always desirable in stoker-fired plants of any size, because they eliminate additional handling of the coal within the boiler house, permitting the coal to feed to the stoker hoppers through downspouts by gravity. The bottoms of these bunkers slope at an angle of from 35 to 45 degrees, the angle being just a trifle greater than the angle of repose for coal. Convenience in framing makes the 45 degree angle more desirable.



A weighing scale which weighs the coal in transit over the belt conveyor.



Why the light shines bright tonight along Main Street

THE light shines bright tonight on your town's Main Street largely because mechanical stokers in the power house are on the job.

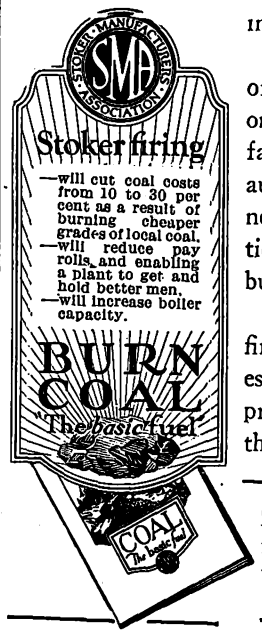
The stokers were probably placed there during recent years—were placed there because the use of more electricity had called for more steam to turn generators, more heat to make steam—more heat than could be produced in the old fashioned boiler furnaces fired by hand.

And the stokers were placed there by men whose business is selling power—and therefore making it at the lowest possible cost. They were placed there because these men knew that hand fired furnaces wasted their chief raw material—coal. The cost of these stokers had to be justified by operating economies—coal and labor saved!

Can any maufacturer who uses steam afford to overlook the example of men who have made power cost a life-time study? Is not coal just as definitely a part of every product as the materials used directly in its manufacture?

There is a type of mechanical stoker for plants of every size—a stoker that will pay large returns on the moderate investment it involves. The manufacturer of that stoker has more to sell than an automatic machine for firing furnaces, he has engineering counsel to offer, the product of specialization in the great cost-cutting field of scientific combustion.

Why coal should be your fuel and why a stoker fired furnace is the way to fire it, is told in an interesting book "Coal—the Basic Fuel." The facts presented in the pages of this book may save you thousands of dollars annually.



Read why you should burn coal and how you should burn it.

STOKER MANUFACTURERS ASS'N
MR. G. A. SACCHI, LESTER BRANCH,
PHILADELPHIA, SECRETARY STOKER
MANUFACTURERS ASS'N

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Mechanical means for elevating the coal to these overhead bins, after it has been delivered to the boiler house, are essential. After the coal has passed through the crusher it may be delivered to a bucket elevator, which is merely a series of buckets fixed to an endless chain belt, which passes over power-driven sprockets. The buckets dip into a boot beneath the crusher and pick up the crushed coal after it passes through the rolls, carrying it vertically upward and discharging it into a horizontal conveyor for distribution to the proper bin in the overhead bunkers.

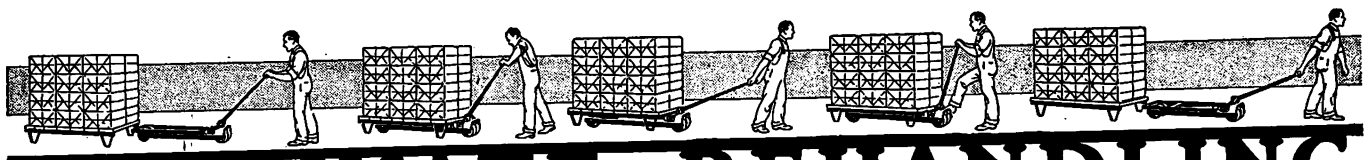
There are many other forms of elevators for accomplishing this purpose and the selection of any particular one depends upon the layout and conditions at the plant. In many cases the skip hoist has been used for this purpose very successfully. In other cases an apron conveyor, and sometimes a scraper conveyor, have been found suitable. Frequently, also it has been found desirable to combine both the elevating and distributing processes in one mechanical operation by the use of a bucket type of conveyor which elevates the coal vertically and carries it horizontally over the bunkers, discharging it by means of a trip located at the proper point.

In such a system as just described, the lower or return run of buckets is usually carried under the boiler room floor and serves as an ash conveyor as well. Thus, one mechanical conveyor does the work of three conveyors, namely, elevating coal, distributing coal, and discharging ashes. With this type of conveyor, however, additional mechanical means is required to handle the coal between the crusher and the conveyor proper. This is usually accomplished by a reciprocating feeder, which is adjustable to feed varying amounts of coal. When the distance from the track hopper to the bucket conveyor makes the use of a feeder impractical, a continuous belt feeder is used.

Belt conveyors for distribution of the coal to various bins in the bunkers consist essentially of a thick belt of suitable width, driven by pulleys and carried upon idlers, so arranged and mounted that the belt assumes the shape of a trough, in which the coal is carried. Usually the belt is composed of woven cotton duck covered with a special rubber compound on the carrying side and has unusual wearing qualities. In the middle the thickness of the rubber is increased, since the service will be severest at that point. The belt thickness is uniform, however, throughout its width.

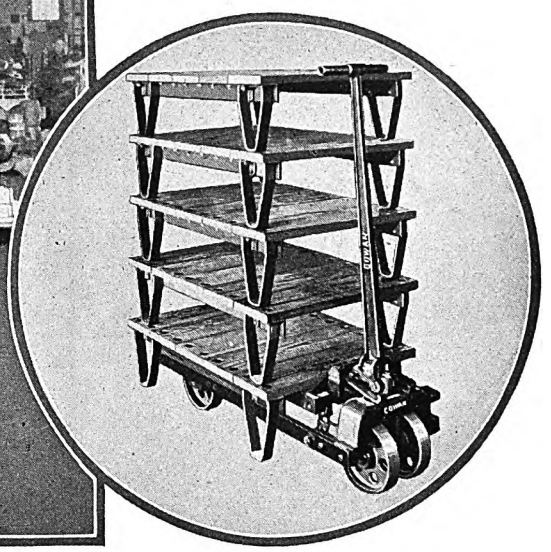
Automatic tripping devices are provided at proper points and cause the coal to be discharged where it is wanted.

In some cases economical methods of handling coal are possible without the use of conveyors, even in large central stations. The power plant of a large traction company in Illinois is so designed that railroad cars dump into unusually large hoppers beneath the tracks. Narrow gage industrials cars of 1-ton capacity run under these hoppers and receive coal from the hoppers by opening coal valves located at regular intervals. These indus-



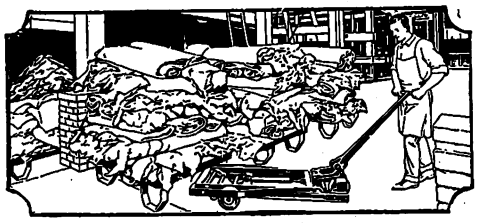
ELIMINATE REHANDLING





Cowan Hand Lift Truck and skid platforms in the drill press department of a large manufacturing plant. Rehandling of incoming and outgoing materials is entirely eliminated.

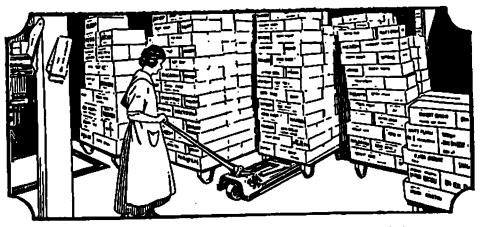
Cowan Hand Lift Truck and Skid Platforms



Here, stored skins are quickly and easily moved by the Cowan System without rehandling.



Manual handling of these heavy loads would be slow, costly work. Quick, easy work here.



Through the Cowan System, even a girl can move loads weighing several thousand pounds.

This System has reduced material handling costs for thousands

In shop, warehouse, and factory—in businesses covering a range too wide for simple classification—the Cowan Hand Lift Truck and Skid System has effected remarkable material handling economies.

So broad has been the application of the Cowan System that it is quite probable that you, too, could save many thousands of dollars per year through adapting it to your own needs.

Why not see for yourself how the Cowan System has reduced handling costs in your particular line of business? Just write, briefly describing the goods or materials you handle, and we'll gladly send you information pertinent to your own problem.

COWAN TRUCK CO., 6 WATER ST., HOLYOKE, MASS.

Representatives in New York, Chicago, and other Principal Cities.

Largest Manufacturers of complete Hand and Electric Industrial Truck Systems.

2068-N

COWAN INDUSTRIAL TRUCKS-TRACTORS

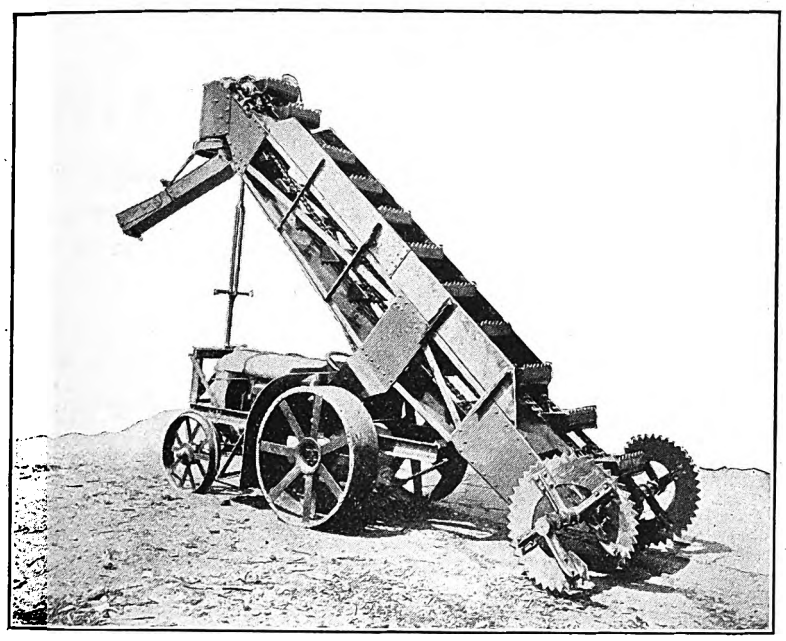


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Why waste

Money-Time-Labor

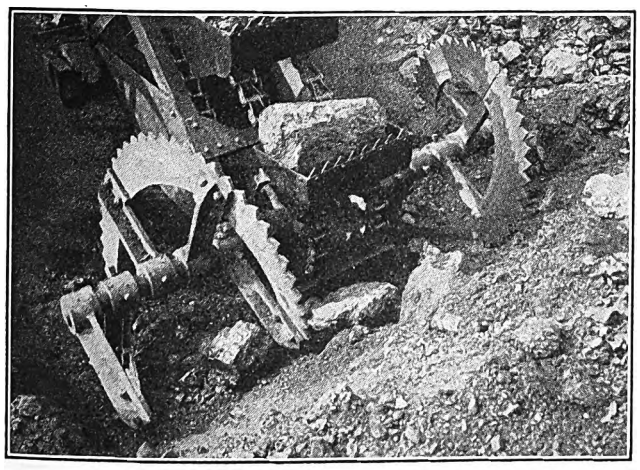
shoveling coal?



When the **NELSON**

Fordson Truck-Loader

will load 30 to 35 tons of coal an hour from stock-pile into trucks.
One-man operation.
No hand shoveling.
Cleans up as it goes.
Swivel spout for side or end loading.
Only eight feet high when lowered.
Use it for coal, ashes, sand, gravel, etc.
Loader readily removed when tractor is desired for other service.
Furnished complete with tractor, or mounted on your own Fordson.



The business end—in soft coal

N. P. NELSON IRON WORKS, Inc.
200 40th Street, Brooklyn, N. Y.

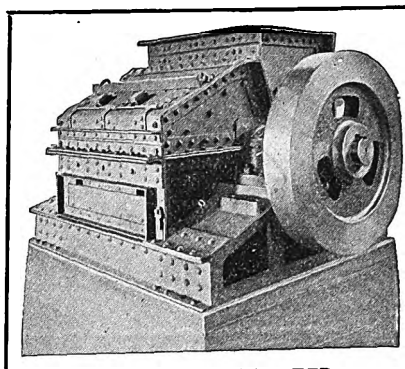
trial cars are of special construction with roller bearing axles and a combined ratchet lift and friction dump. They are pushed on to one of two elevators which lift them to another track above the bunkers, where they are dumped at the desired point. Four men handle the coal and ashes for the ten boilers in this plant.

Another large central station in the middle west has a slightly different coal handling system from any yet described. It consists of a receiving pit beneath the railroad track outside the boiler house. Directly above this track an overhead storage of 1,600 tons capacity is carried on suitable steelwork. Above the storage bins an electric hoist operates to raise the coal from the receiving pit and distribute it to the bins, whence it flows by gravity into the stokers in the boiler house. One man and a helper, working five hours a day, handle an average consumption of 200 tons with this system.

Simplicity and reliability are the two main factors to be considered in the selection of a system for handling coal. It is sometimes possible to design such a system that will handle coal directly from the cars or from the receiving pit, either to the bunker in the boiler-house or to the outside storage pile, and, at the same time handle all the ashes and refuse, with the same mechanical equipment. This very thing has been accomplished with the electric hoist and trolley, running on an overhead track and hoisting coal from the delivery track and carrying it into the building itself, or in the opposite direction to the adjacent storage pile.

As a rule coal is fed from the overhead bunkers to the stoker hoppers directly through downspouts. Some plants have found it desirable, however, to omit the continuous spouts for each individual boiler and to substitute instead one or more weighing hoppers, operating electrically on a track underneath the bunkers. From the hoppers a spout extends out to the stoker hopper. In this way the coal fed to each individual stoker may be recorded. A single weighing hopper is sufficient to serve several stokers and may be quickly shifted from one unit to another. Such

(*Continued on page 61*)



"PENNSYLVANIA" SUPER HAMMER MILL
Weight 20 tons.

Quarry Iron

THE 16" steel wedge, shown below, is *tough* Hammer Mill "fodder," but.....



the Patented Tramp Iron Separator in a "Pennsylvania" Super picked it out automatically without damage to the Mill,—and unknown to the operator.

This device is only one of the many SUPER factors in powerful STEEL-BUILT "Pennsylvania" Hammer Mills, which justify careful investigation.

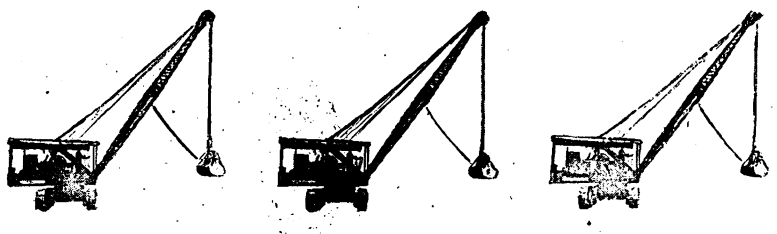
"Pennsylvania" design insures the *lowest cost per ton, for the long pull,* rather than the *lowest price per pound of machinery.*

New Bulletin 1005 outlines SUPER Design and Service. Send for your copy.

PENNSYLVANIA CRUSHER COMPANY
1320-1325 Stephen Girard Bldg.
PHILADELPHIA, PA.

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One out of every three NORTHWESTS is a repeat order



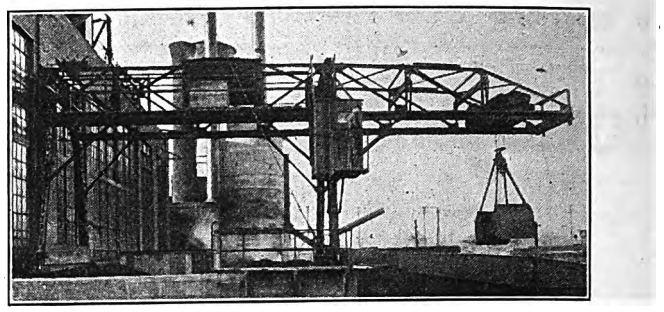
There is no greater testimonial of satisfaction than repeat orders for NORTHWESTS from responsible concerns.

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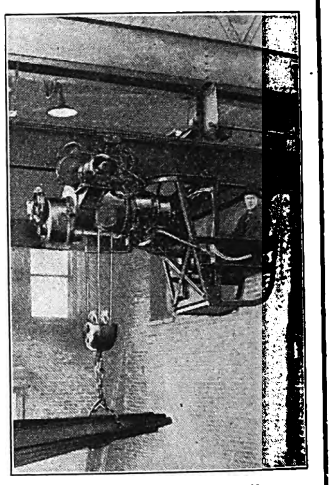
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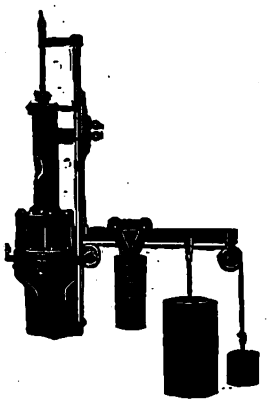
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Better Control of Operating Pressures Cuts Boiler Room Costs—



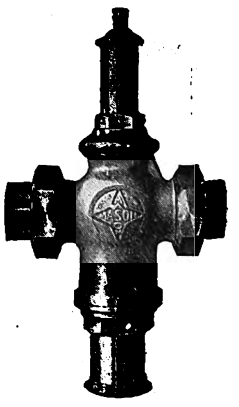
Mason Damper Regulator for the scientific control of boiler pressure by the flue damper or forced draft.

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hoppers are built for automatic recording of coal weights, or they may be equipped with the usual scale arm extending downward within the reach of the fireman on the floor.

The importance of including in the design of any coal handling system, no matter how simple, adequate and convenient means for weighing and recording the amount of coal burned cannot be over-emphasized. Such records are essential information from an operating standpoint.

For the hand-fired plant, where coal is delivered to the boiler house in trucks, barrows, industrial cars, or the like, there should be platform scales at least and a blackboard nearby for chalking up the weights. The same applies to the delivery of coal in railroad cars. In the latter case the weights can be taken on the yard scales.

Where automatic conveying machinery is used, automatic recording scales are available for registering the amount of coal passing over the system. The traveling larry with suitable weighing hopper inside the boiler house affords another means for weighing the coal as it is burned.

There is no one best coal handling system for all plants. Each individual plant has conditions peculiar to itself. The lay of the ground, the design of the building, the amount of coal burned, the kind of coal used and many other factors will exert their proper influence to determine what sort of coal handling system is best adapted to each plant. One thing is certain. For any given plant there is a system which will be simpler, more reliable, more economical than any other. That is the system you want.

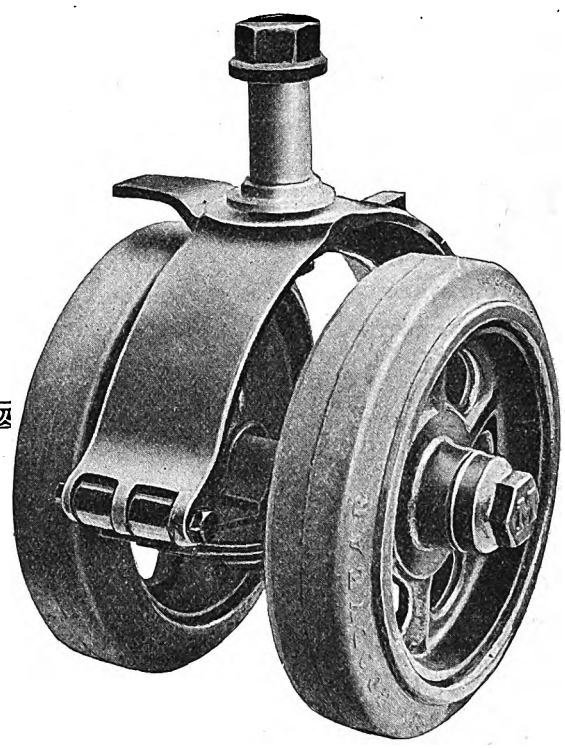
A strong plea for the education of industrial employees in the fundamentals of business economics and in the details of the businesses in which they are employed is made by Carl F. Dietz, president of the Bridgeport Brass Company, in a pamphlet recently issued by the Fabricated Production Department of the Chamber of Commerce of the United States.

The methods employed by Mr. Dietz's company are unique. Employees are educated through lectures and by means of simple visual illustrations. In the place of charts and graphs blocks of colored wood are used.

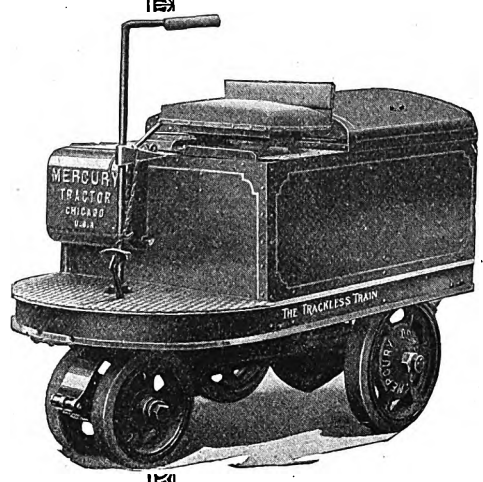
Workers who perform certain operations on materials before they have reached an advanced stage towards completion often show little interest in their work because they never see the start and finish of the job on which they are employed. There is manifest at all times, declares Mr. Dietz, a real desire on the worker's part to know more about the business in which he is employed. Far seeing managers, he adds, are seeking the best methods of imparting such information constructively, especially information regarding the relation of production to wages and the distribution of the dollar received for the product of the plant.

Copies of the booklet may be obtained by addressing the Chamber of Commerce of the United States, Washington, D. C.

Full Spring Suspension *in the* Mercury Type L-"Twin-3"



"Twin-3" front wheel assembly — an exclusive patented Mercury feature.

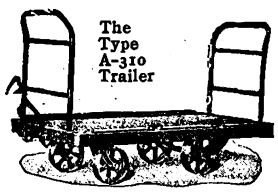


The Mercury Type L-"Twin-3"

THE importance of spring suspension for an industrial tractor can scarcely be over estimated. Springs make for long life and economical maintenance, because they cushion the working parts, and most important of all—the battery. In addition, springs assure constant steering and traction contact and comfortable riding for the operator.

The Mercury Type L-"Twin-3" is unique in its combination of all the desired features—simplicity, short turning radius, and full spring suspension, front and rear, on long period semi-elliptic springs. Hundreds of Mercury Tractors at present in service equipped with the "Twin-3" front assembly have conclusively proven the value of this feature.

There are four other types of Mercury Tractors to meet every industrial need.



The Type A-310 Trailer

TRAILERS

The Mercury Manufacturing Company also produces *good* Trailers for operation with Tractors in "trackless trains." This company was the pioneer in the industrial tractor field and for more than eight years has built nothing but Tractors and Trailers.



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U. S. Fuel Distributor Wadleigh Says:—
"Store Coal Immediately!"

THIS warning followed a report from the American Railway Association, which has advised that

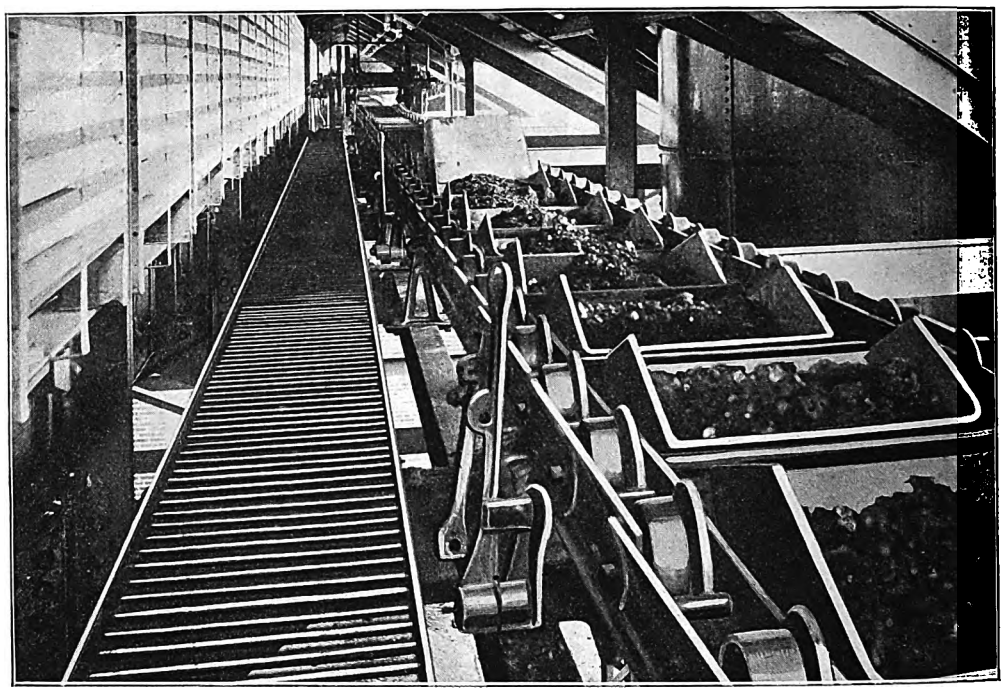
"If coal consumers do not now purchase coal in anticipation of fall and winter requirements they will experience difficulty in procuring it later when railways are taxed with a heavy movement of general traffic, and particularly agricultural products."

HERE is a warning to which every industrial user of coal should give instant attention. To heed this advice is to save many agonizing hours later on, when peak prices prevail and coal supplies are scarce. Coal is cheaper than it has been for a long time, and plentiful.

But don't let the storing and handling of your coal —and the removal of the resulting ashes—become too costly.

Hunt Cost Cutting Equipment is the result of over half a century experience in the economical, rapid, labor-saving and safe handling of coal, from barge or car to storage or boiler room hoppers, and the removal of ashes from the pits to car or storage.

Hunt engineers with their broad experience in meeting satisfactorily many difficult problems, and with their vast store of information to draw upon, can devise a suitable handling system that will expedite the storing of coal and lessen the cost of producing power. A word to them will bring an immediate response.



No. 04136
Upper run of the Hunt Conveyor over the coal storage bins. The same conveyor is used for handling the ashes.

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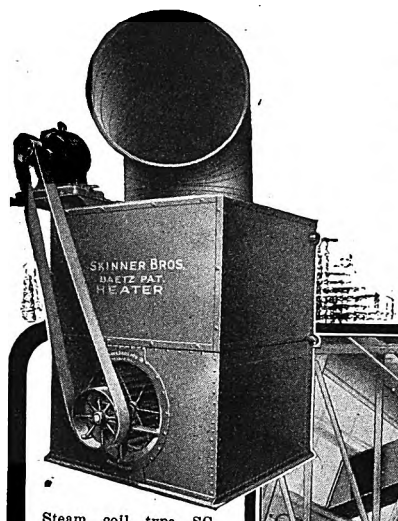
He Chased the Rainbow— Caught It—and Put It to Work

(*Continued from page 11*)

ent-day position in a list compiled by town-boosters from the census. Litchfield men and women are to be found in all parts of the country, and in positions of leadership wherever they are. When Frederic Ives was a boy there, in the days before it was submerged by the bigness of big cities, and before the old New England stock was diluted by the deluge of immigration, the Litchfield atmosphere had the opportunity in all its potency to saturate him through family, neighbors, playmates and schoolmates.

There is nothing fanciful in that statement. Why does Italy produce so many musicians? Is it not because the Italian atmosphere is musical? Its boys and girls all over the land from their infancy hear voices and instruments all around them making music of the highest order, so that it excites no comment—is not "queer"—when they, too, raise their voices in song, and ing song that is classical. So, here in America, the atmosphere is such that our boys naturally "make things" and are continually putting things together or taking them apart, to make new things. And if that atmosphere has any point of concentration, it is, or was, the state of Connecticut.

The evidence of it in Fredric Ives is that, after working on his father's farm, then in his father's store in town, and learning the printer's trade so that at sixteen he was a journeyman printer, he found the time and the means somehow out of his slender resources to follow his hobby of photography. It "got" him so completely that at nineteen years of age he went to Cornell University, not as a student, but to get a job in the photographic laboratory. He looked so much the awkward, hard-worked country boy that Professor Anthony, yielding to his



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Industrial heating has actually been revolutionized by the Skinner Bros. (Baetz Patent) Heater—it is the original heater of its type and uses no outside pipes or ducts as warm air carriers. It distributes warmed air evenly throughout every portion of the open area of a building and also acts as a ventilator and air conditioner, either in Summer or Winter.

Think About Next Winter, *Now!*

DON'T *worry* about heat next Winter—*think* about it now and you will do as hundreds of others have done before. Install Skinner Bros. (Baetz Patent) Heaters and forget your heating troubles.

The Skinner Bros. (Baetz Patent) system is entirely different than old time heating methods and when you install it you can be definitely certain of these things:—

(1) It will positively heat every part of the open area of your building. Satisfactory operation guaranteed.

(2) It will act either as a heater or ventilator or as a heater and ventilator combined. It can also be used as an air conditioner in connection with its use as a heater.

(3) It is quite economical to install and operate.

Think over this matter of heating and ventilating your plant—it is something that should have your attention now. Investigate the Skinner Bros. (Baetz Patent) system—send for catalog D-9.

Used by Hundreds of Large Concerns

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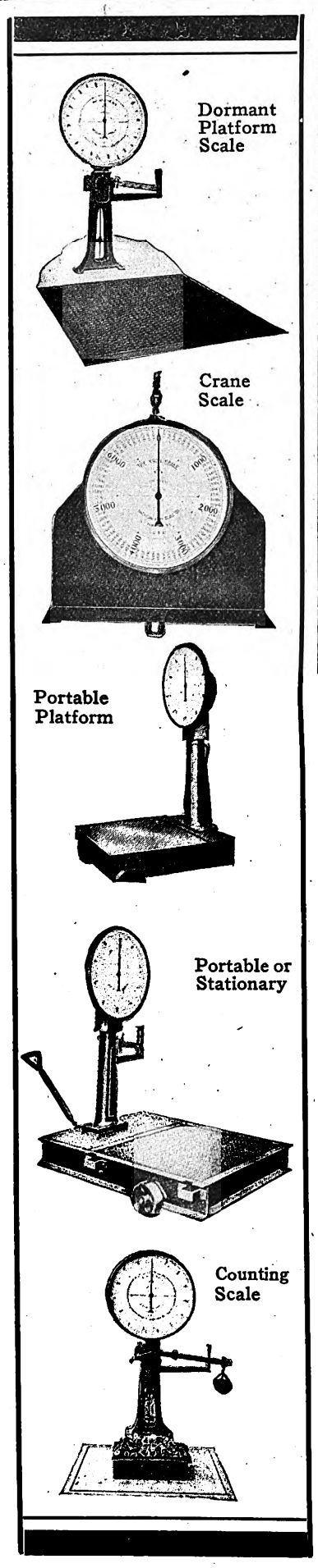
Skinner Bros. *Baetz Patent* HEATING SYSTEM

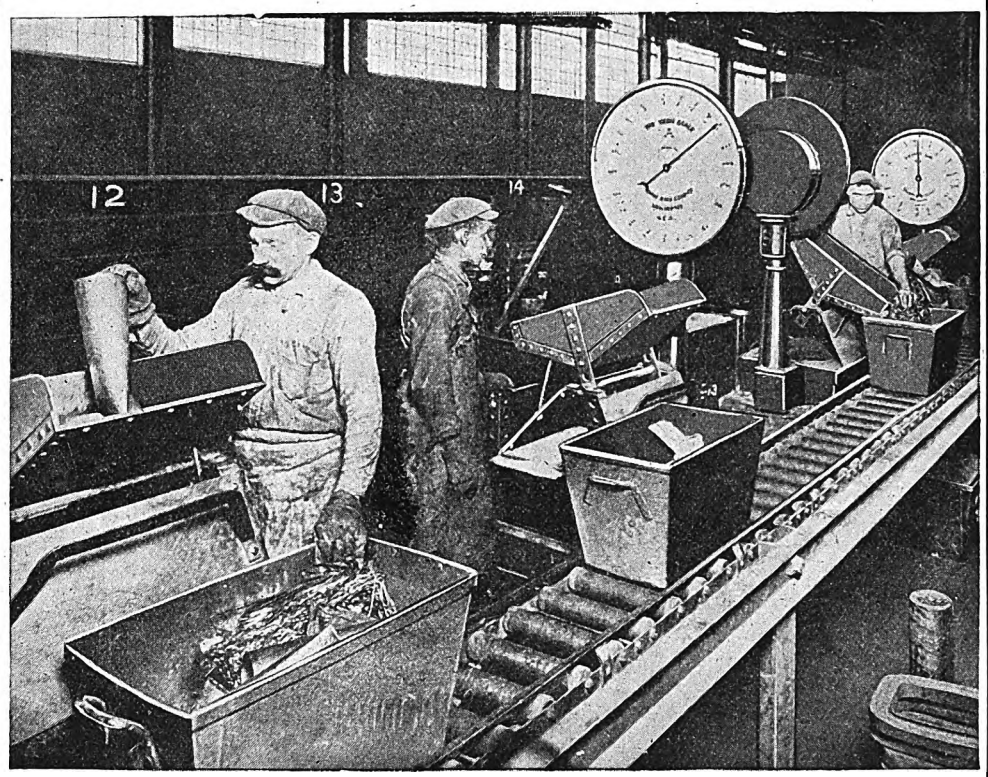
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importunity, put him to work as the surest way to eliminate him in the few days it would take to show up his unfitness. The few days lasted four years for the simple reason that no one else accomplished the things he did. He thus showed his good judgment by getting into a laboratory that was among the best in the country, where he would be sure of facilities he could not expect to get elsewhere both to learn what others were doing and to follow out the workings of his own eager mind in research and experiment.

So thorough was he in his endeavor to find a method of printing pictures that he undertook to learn wood-engraving. He had enough of it to give him an insight into the limitations of that art both in production and reproduction which made him all the more determined to substitute a mechanical process which should make possible the printing of photographs cheaply and in quantity on the ordinary printing press. He succeeded in a surprisingly short time, considering that he was only twenty-two years of age when he was able to patent the first practically successful process of half-tone photo-engraving. Other men in England, France Germany and the United States had been experimenting and patenting processes for over twenty years which were only partially successful. It was a noble line of predecessors in whose footsteps this Yankee boy trod. There were Niepce, Daguerre, Goddard, Claudet, whose names mark the milestones along the road which finally reached the goal of giving an inanimate plate the power of seeing equal to that of the human eye, and the power, exceeding that of the human eye, of retaining permanently the seen image. Then came the efforts to add still another power, that of multiplying the image for millions of other eyes to see. And later came yet another power, adding motion to the pictures; then color; then three-dimensional form; and lastly creating complete illusion by including the voice, music or other sounds of the scene. It is just a century since Niepce fixed his sun-pictures on silver-plated copper. In that century the whole road has been traveled. And no one man has carried the basic science and its application in practical mechanisms so far along that road as Frederic Ives. Take a shelf full of the yearly or half-yearly reports of the Patent Office running back to 1880 and in nearly every one you will find his name as a patentee, often more than once, sixty-five or seventy times in all. Most of his inventions have to do with optics, but along the way he found time to work out such other things as an oxy-hydrogen blowpipe, a saturator for blowpipes, a self-playing piano.

As early as 1852 a patent was granted to Fox Talbot for a method of breaking up a picture on a printing surface in such a way that it could be made to take the ink and print the picture. His finished plate was an intaglio, that is, the ink was taken up by the depressions in the surface and not the projections. He was sufficiently comprehensive, certainly, in the means he employed to do the breaking up. He used mus-





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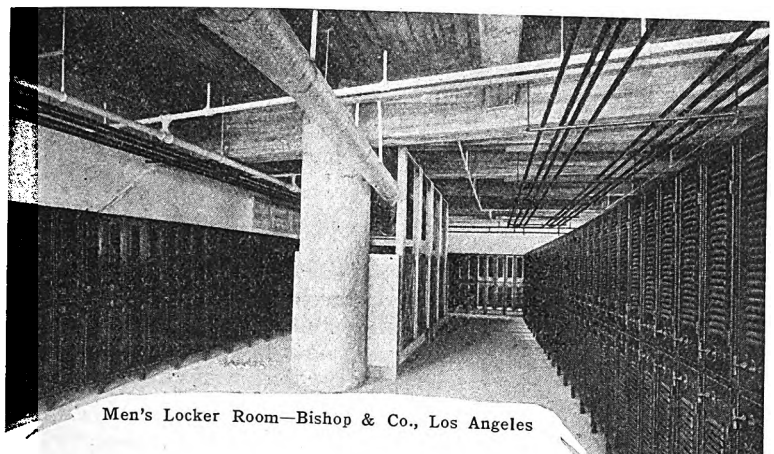
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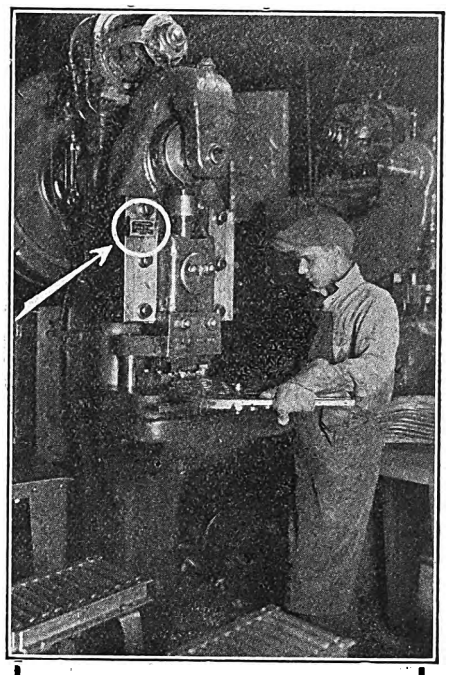
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lin, crepe, fine lines on glass, or grains of powder on glass. In 1854 Paul Pretsch endeavored to accomplish it by the reticulation of gelatine. A year or two later Berchtold brought out a purely mechanical method of stippling the printing plate. Then in 1860 Asser used starch granules. Swan tried mixing grit with gelatine. Bulloch went back to the Talbot idea of using fine fabric, and Swan went a step farther by using Bulloch's screen, but moving it slightly during the exposure. So they groped. Ives, in 1878, while he was still in charge of Cornell's photographic laboratory succeeded where the others had failed, and produced the first half-tone process which was capable of commercial development. But even this success was only a beginning. It took him eight years more to achieve what he was really after and perfect the modern etched half-tone plate, with the stippled effect produced by means of a cross-ruled glass "pin-hole" screen interposed between the original picture and the printing plate with its sensitized surface. The plates he made by this first process were much the same when finished as the half-tone cuts that are now so familiar, but their production had several disadvantages. The stippling or breaking-up of the picture was accomplished mechanically by using a ruled elastic dotted V-line stamp inked and impressed upon a photographic relief instead of the cheaper, quicker and more effective operation effected by means of the pin-hole screen, which acted in a very ingenious and scientific way as an optical substitute for the mechanical V-line ruling. When he perfected this process Ives was in the employ of the Crosscup & West Engraving Company of Philadelphia, for whom he had established their photo-engraving plant in 1879. On their advice he did not patent his perfected half-tone process and thereby missed his chance of becoming the rich man he ought to be today, since his invention is in world-wide use.

But Frederic Ives wastes no time in bitterness or regret over what might have been. He gets his pleasure, as he says himself, out of being able to write "Q. E. D." at the end



In the Ford Body Shop Production Checked with model "B" Gear Counters

These give a reliable check on production. And the choice was R. A. HART Gear Counters after thorough investigation of the various methods used in industry for checking output per man.

In the body shop at River Rouge every machine is equipped with a model "B" Gear Counter and throughout the Ford plant 2100 HART Counters are in use. Cost of maintenance almost nothing.



R. A. HART Gear Counters

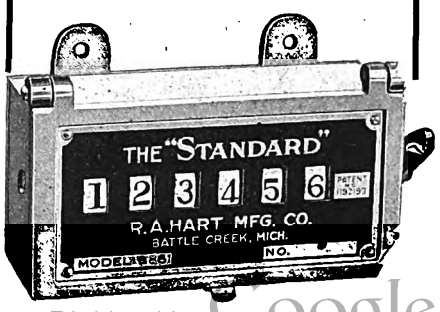
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They register up to 100,000. Constructed on gears—can be reset in a moment.

R. A. HART Counters have large plain figures—Steel Shaft—Steel dogs and Steel rachet wheel hardened.

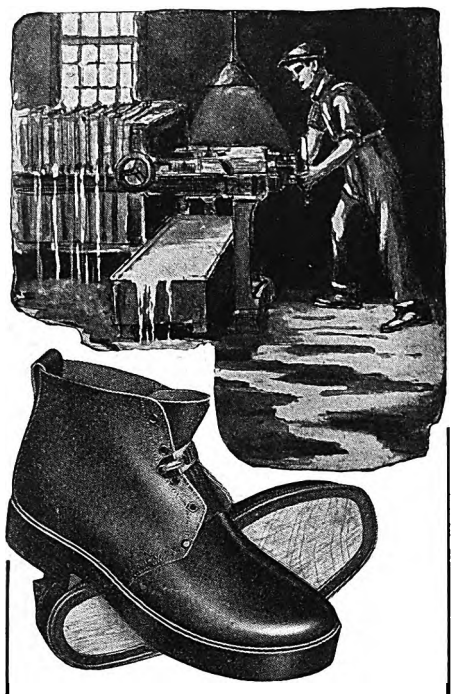
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of his self-imposed problems, and then is willing to let the world enjoy the answer after he has put it in the back of the book. He's the sort who would enter the Olympic games for the laurel wreath and ignore the prize ring with its million dollar purse. He has not missed wealth by being a high-brow inventor with the usual "wheels in his head," and lacking business sense. He has deliberately put aside the commercial development of more than one of his creations simply because he doesn't want to stop by the way long enough to do that. It would take too much time from his work, his work being the study of certain deep problems in light and color and the development of appliances in that field for the uses of pure and applied science.

"How rich, how poor, how abject, how august,
How complicate, how wonderful is man!
How passing wonder He who made him such."

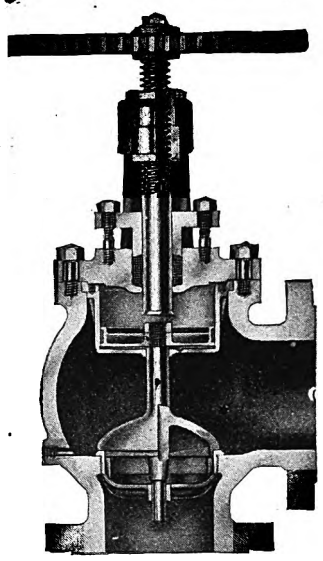
The farther we go in probing the works and the laws of the Creator, the more infinite we find the reaches before us. Once upon a time light had a simple definition. It was just the absence of darkness. Anybody with eyes knew what light was. "Darkness was upon the face of the deep....And God said, Let there be light; and there was light,....And God called the light Day, and the darkness he called Night." Simple. Any Sunday School scholar knew all about light. Light in nature, and the corresponding sense of sight in man, were provided so man could see his surroundings, distinguish the good from the dangerous, enjoy the one and avoid the other. Simple. Easy. But nowadays the single phenomenon, light, is so far from simple that while Einstein in one direction works on the problem of its material and ponderable character, and Roentgen demonstrates its action upon living tissues apart from the optic nerve, Ives will not pretend to know anything about light as Einstein and Roentgen know it. He studies and works with light along the path of its optical manifestations and effects, its color composition, its actinic power, the appliances wherewith he may

(*Continued on page 68*)

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Jenkins Bros



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For safety— for boiler efficiency

JENKINS Automatic Equalizing Stop and Check Valve is designed to automatically shut off the flow of steam from the header to a boiler in case a tube should burst or other internal rupture occur.

It also equalizes the pressure between boilers in a battery, and automatically cuts in a new boiler when it gets up to pressure. Valve can only be opened by the pressure in the boiler to which it is attached.

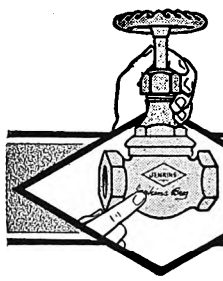
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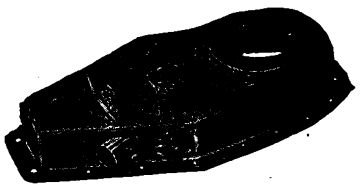
Jenkins Valves

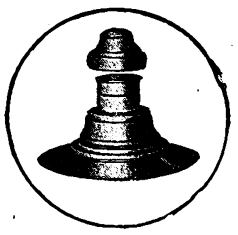
SINCE 1864

G.P.&F. Service
Knowing How Since 81

Special Stampings, Sheet Metal Parts 100,000 Parts Every Day

Made to Customers' Order and Design





OUT of this great plant there flows a constant stream of all manner of sheet metal Parts for all lines of industry. Stamped, Drawn, Spun.

Facilities great enough to meet the demand for large quantities.

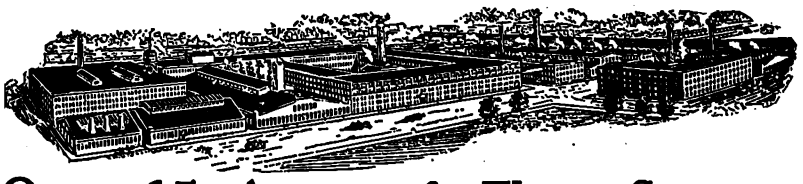
Modern equipment and efficient production methods enable us to quote prices lower than the cost of making a similar article in your own plant.

We are ready with proof.

Send blueprints or samples for estimates and make comparison. We weld all sheet metals.

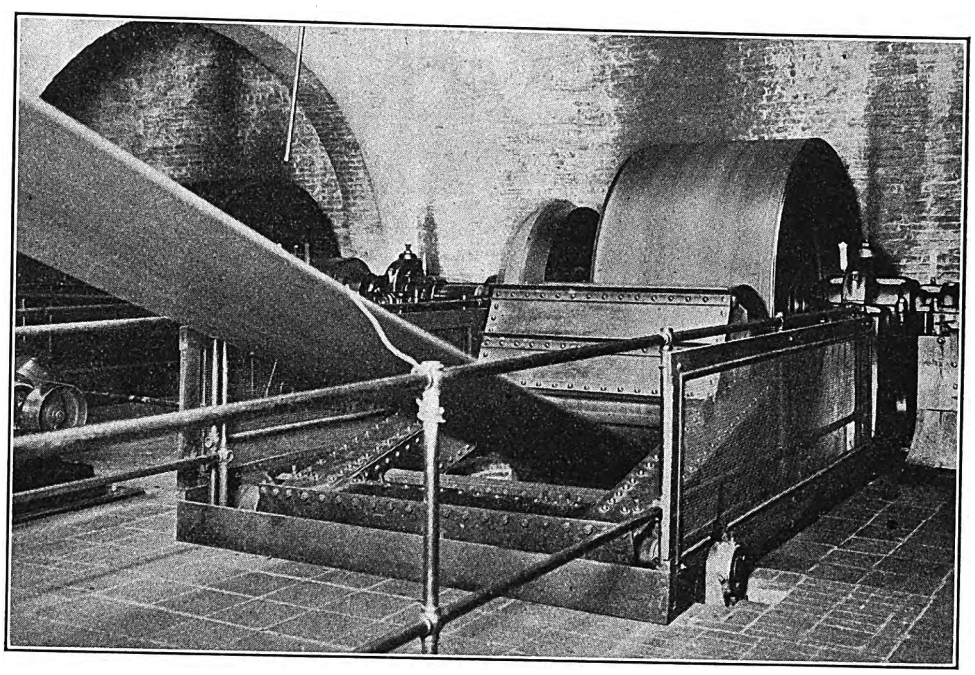
GEUDER PAESCHKE & FREY CO.

1457-1750 CANAL ST., MILWAUKEE, WIS.
CHICAGO: 352-358 WEST OHIO STREET



Over 15 Acres of Floor Space—

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Point Number One—"Arc of Contact"

SEVERAL FACTORS must be taken into consideration in planning a belt drive to insure its successful operation. The most important of these is the *arc of contact* between the belt and pulleys.

An arc of contact sufficient to transmit the load may be obtained by two methods:

Natural—by the use of long pulley centers and slack belts, involving a large amount of floor space

Artificial—by the use of tension idlers or idlers of the flexible, resilient type when acting as belt wrapping devices, such as

THE LENIX DRIVE

A lack of floor space may prevent the use of the natural means. Where the necessary floor space *is* available it is expensive to use it for the purpose of giving long pulley centers to a belt drive. The disadvantages of the tension idler offset the benefit obtained through the slightly increased arc of contact it creates.

For eighteen years we have been building the "belt wrapping" LENIX DRIVE and are the pioneer manufacturers in this country of this type of drive.

At the plant of a brick manufacturer in New Jersey, a 1400 HP Corliss engine could not deliver more than 900 HP because, through lack of sufficient arc of contact, the belt would not hold on the lineshaft pulley when the load was raised about 900 HP.

A Lenix drive was installed and, as illustrated, is wrapping the 50", three-ply belt around practically three-fourths of the circumference of the lineshaft pulley, and the engine is now delivering its full capacity.

Booklet "Saving Slippage and Space" tells how it is done.

How belt tension is reduced, rather than increased, by the Lenix will be told next month under "Point Number Two."

FIVE POINTS

1—The Lenix increases the arc of contact between belt and pulley.

2—The Lenix maintains constantly and accurately the proper tension in the slack side of the belt.

3—The Lenix saves floor space, building space and belting because of freedom in pulley locations.

4—The Lenix saves in bearing friction, lubrication and renewal of bearings because of reduced bearing pressure.

5—The Lenix permits the use of less expensive, high speed and high efficiency motors or generators because of the higher pulley ratios.

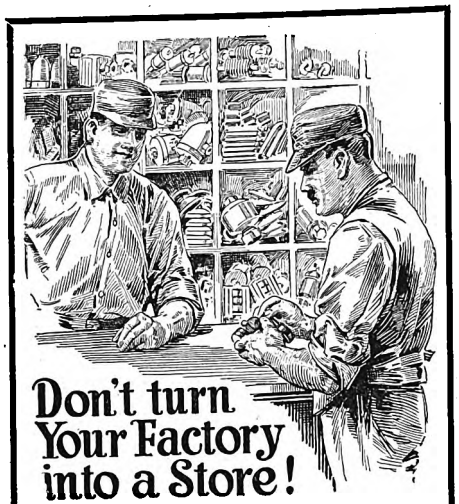
F. L. SMIDTH & CO.

ENGINEERS

50 Church Street — **New York, N. Y.**

THE LENIX DRIVE

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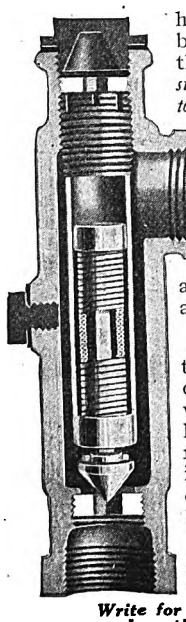
Don't turn Your Factory into a Store!

Most plants that use ordinary traps are virtually compelled to "keep a store" in order to maintain a supply of extra parts sufficient to take care of repairs. For some bucket traps have as many as 43 parts that may require replacement. This not only means a lot of money tied up, but it means that you are paying someone to *make the repairs!*

The Steam Trap Sarco, on the other hand, has but five parts, and only one that moves. Consequently, there is practically nothing to wear out and require replacement in the simple

STEAM TRAP SARCO

Another thing, most concerns keep a few extra traps on hand for emergencies. Here again the Sarco saves money as it costs about one-third the price of bucket traps.



The next time you have a steam trap breakdown remember that *it costs less to install a new Sarco than to repair a worn out bucket type trap.*

Hence, in most cases, you actually save money by scrapping your old trap and replacing it with a brand new Sarco.

The Sarco drains the condensate as quickly as it forms with minimum loss of heat, instead of permitting it to collect in volume and cool off. Saves valuable heat units.

Made in sizes from ⅜ in. to 3 in., for pressures up to 200 lbs.

Write for Booklet R-32 and particulars of our 30-Day Free Trial Offer.

SARCO CO., INC.

236 Broadway, New York City

Buffalo Chicago Cleveland Detroit Philadelphia

(*Continued from page 66*)

employ it in the form of transmitted or reflected light to reproduce the image of the natural object, still or in motion, flat or solid, in monotone or color, of actual size or magnified or minified. That's work enough for one man in one lifetime. In fact, a lifetime is not time enough.

Much of Mr. Ives' work is little known to the general public, and much that is known is not known by his name; the half-tone, for example. Scientific societies bestow fellowships and medals upon him for such discoveries and inventions as the parallax stereogram, for instance, but what man in the street, passing the "changing pictures" in the store windows wherein the pretty girl is seen sucessively smiling and frowning, knows that he is looking at an adaption of the invention with the scientific Greek-Latin-English name? As seen in the physical laboratories of institutions of learning, the parallax stereogram is a stereoscopic picture without a stereoscope; a photographic print on a flat plate of glass which, when held at arm's length, "stands out" in perfect relief. That was a sufficiently remarkable accomplishment to call forth medals from the Royal Photographic Society and the Franklin Institute. But if it has commercial possibilities beyond his modification of it in the familiar "changing pictures" for advertising purposes, somebody other than its inventor will have to discover and apply them. He is busy, too far ahead on the road to other things.

While we are on his more purely scientific productions, there is the modern high power binocular microscope. Ask the research chemist or physicist how useful that instrument is to him in studying certain effects upon the structure of materials during the processes of experimentation or testing. One does not have to be so very old to remember that in his study of physics there was just one way to get a solar spectrum, and that was by refraction with a glass prism. But, like many other things of the good old times, the prismatic spectrum, pretty as it was, had serious faults. It didn't tell the truth. Due to the varying

"Van Dorn" Electric Grinders



You Wouldn't Buy a Pony for Dray-horse Work.

How about Horsepower in Your Electric Grinders?

When you buy "Van Dorn" horsepower—you get what you pay for—a "Van Dorn" Motor, insulated, tested and rated in accordance with A.I.E.E. standard. Every motor guaranteed to stand up under continuous production.

WHY EXPERIMENT? "Van Dorn" has done that for you.

A factory expert is in your territory. He would like to talk it over with you.

The Van Dorn Electric Tool Co. Cleveland Ohio

Sales Offices in all Principal Cities

NEW UHL STEEL VAULT TRUCK



ADJUSTABLE—LOW IN COST—
STRONG AND DURABLE

HAULS BOOKS, LEDGERS, CARDS AND STANDARD SECTIONAL FILING DEVICES.

THE TOLEDO METAL FURNITURE CO.

1610 HASTINGS STREET TOLEDO, OHIO

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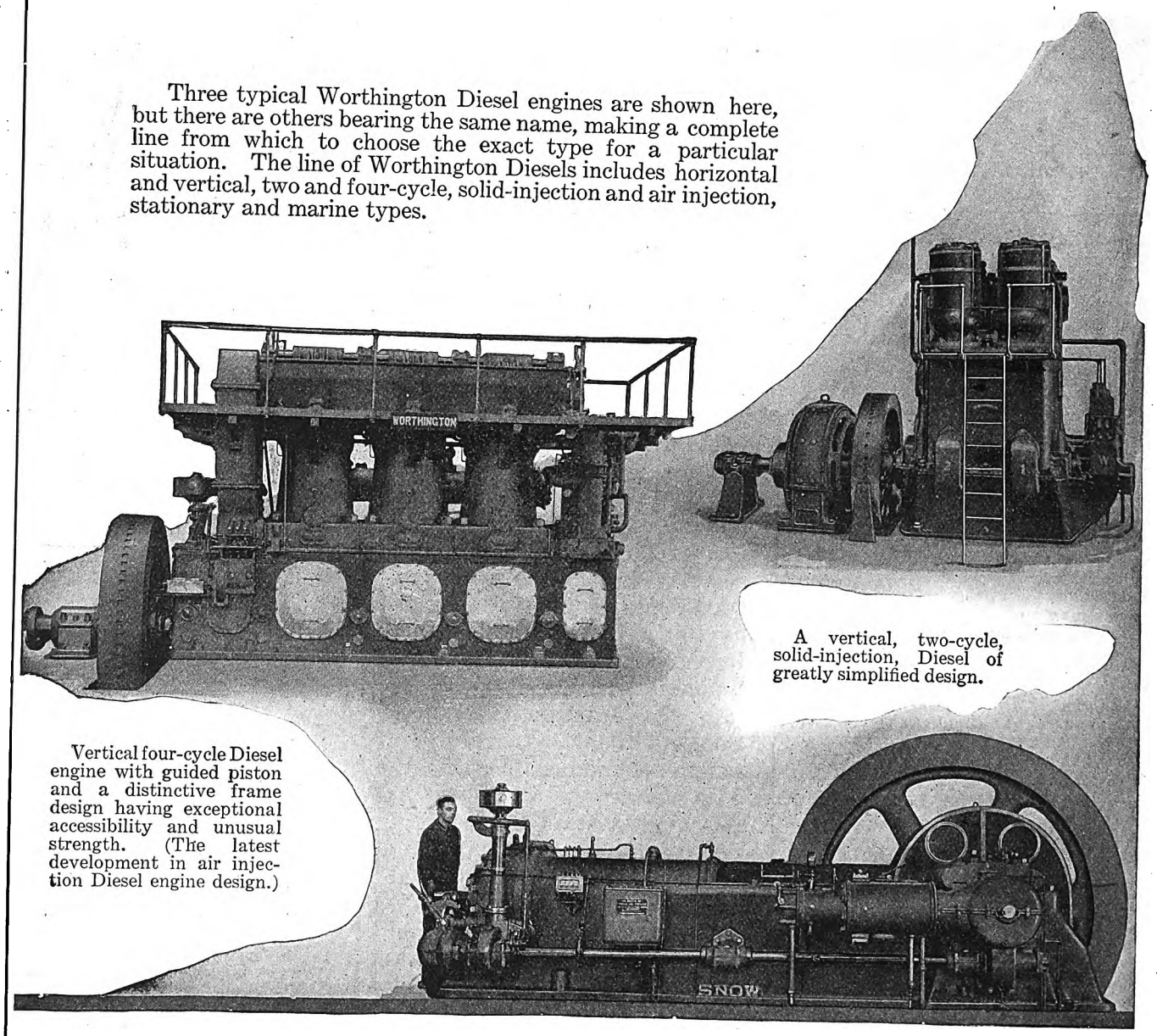
refrangibility of the light rays of different colors, it crowded the bands of light toward the red end, and spread them toward the violet end. Professor Rowland, of Baltimore, broke up white light into its constituent colors by ruling fine lines, tens of thousands to the inch, on a smooth surface. The minute corrugations interfered with the wave-lengths so they were separated and regrouped into color bands as in the prismatic spectrum, but with the important difference that the width of the bands was in true proportions. Mr. Ives multiplied the use of the Rowland diffraction grating, making it immensely more serviceable to the scientific and industrial world at large by cheapening it without sacrificing its accuracy. Rowland used a metal surface; Ives reproduced the surface as a "glass sealed diffraction grating," and the Ives gratings are used in laboratory spectroscopes the world over.

But here is something that solves an age-long problem of simpler appeal. What woman, and what archeologist, for that matter, would not like to know exactly the shade of Tyrian purple? When I say scarlet do you see vermilion? Two or three shades lighter means one thing to me, and another to you. We cannot match a color without putting the two objects side by side and then trusting to the trueness of our eyesight, which may easily be made doubtful by varying light intensity, by different surface, texture or material. But this master of light and color has forever leashed the elusive color-quality of light, he has eliminated another factor of the human equation, he has lifted us out of dependence upon the keenness of one of our senses to the solid footing of scientific, mathematical unchangeable certainty. With the Ives colormeter, colors can be matched though they be on opposite sides of the world; a century after they have faded they can be reproduced exactly. The instrument gauges a color or a tint by its hue and intensity with entire precision and registers it by a combination of three numerals. It is capable of a million variations in color and shade. The registered number being sent to another person with a colorimeter, he has simply to set his instrument to the given number, and the resulting combination on the color register will be exactly the same as that on the first instrument. And the result will be identical anywhere and for all time. Naturally this instrument should be of immense value in laboratories and industries wherever color plays an important part.

Countless commercial and experimental operations require exact identification of colors and shades. Heretofore there has been only a nomenclature in which there were lamentably few terms of fixed meaning having exactly the same significance to the senses of all who used them. For the remainder, words have been borrowed from all sorts of sources and used more or less sensibly or fancifully according to the taste, usually, of the coiner. "Orchid" on one color card might be "Honeydew" on another. "Sea green" and "Pea green" might be nearer alike than their spelling. But now Ives has made all that

Worthington Diesel Engines
A type for every service

Three typical Worthington Diesel engines are shown here, but there are others bearing the same name, making a complete line from which to choose the exact type for a particular situation. The line of Worthington Diesels includes horizontal and vertical, two and four-cycle, solid-injection and air injection, stationary and marine types.



A vertical, two-cycle, solid-injection, Diesel of greatly simplified design.

Vertical four-cycle Diesel engine with guided piston and a distinctive frame design having exceptional accessibility and unusual strength. (The latest development in air injection Diesel engine design.)

The Worthington-Snow horizontal four-cycle Diesel engine, a massive, sturdy engine for heavy duty.

WORTHINGTON PUMP AND MACHINERY CORPORATION

Executive Offices: 115 Broadway, New York City. Branch Offices in 24 Large Cities

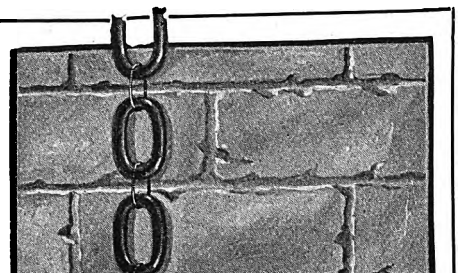
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WORTHINGTON

Deane Works, *Holyoke, Mass.*
Blake & Knowles Works *East Cambridge, Mass.*
Worthington Works *Harrison, N. J.*
Laidlaw Works, *Cincinnati, Ohio.*
Hazleton Works, *Hazleton, Pa.*
Gas Engine Works, *Cudahy, Wis.*
Power & Mining Works *Cudahy, Wis.*
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Those weak links in your furnace lining—

Eliminate them with PLIBRICO

THINK of your fire brick furnace lining as a chain—a chain of brick and cement. Each brick is a strong link; each joint is a weak link. You can increase the strength of the strong links by using better fire brick—but you can't increase the strength of the joints unless you *eliminate* them.

Plibrico has no weak links—no joints. Every part of it is as strong as every other part—and every part is the highest quality of refractory that it is possible to produce. That is why engineers have said that Plibrico could be sold at a price far above its present moderate cost and still be the most inexpensive of furnace linings.

Plibrico saves in application cost—because it is plastic, adaptable to all furnace forms, and is effectively applied by inexperienced labor. It saves in furnace maintenance costs because it outlasts brick linings and can be readily repaired.

It builds up further efficiency because it stops leaks and will stand forcing temperatures to 3100° F.

The extensive book "Modern Furnace Building" tells the story.

Plibrico is delivered only in steel containers of distinctive appearance as shown below. Warehouse stocks are carried in fifty-two cities.

PLIBRICO FURNACE LINING

JOINTLESS FIRE BRICK CO.
1154 CLAY ST., CHICAGO



This 50-page book FREE

Jointless Fire Brick Co., 1154 Clay St., Chicago.

Please send me the 50-page booklet, "Modern Furnace Building"—no obligation.

Firm .....

Address .....

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Name .....

Position .....

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obsolete. No one has to depend on recollection or figures of speech or reference to other colors in nature to visualize or describe the color and shade of the yellow band of light in the spectrum; it is identical in India and Indiana. The wave length will be the same in the twenty-fifth century as it was in the fifth. So, when the Ives colorimeter tags it with a number, mixes it with other eternally fixed colors, tagged with equally invariable numbers, he has achieved for this phenomenon, which from the beginning of time has been only an elusive sense perception, an exactitude practically equal to that of astronomy. The colorimeter is not yet in wide use because for quick industrial laboratory standardization purposes Mr. Ives provided his much simpler "tint photometer," which quickly measures colors without matching them to the eye, and is used successfully even by the partly color-blind. Hundreds of Ives' tint photometers are now in use in industrial laboratories.

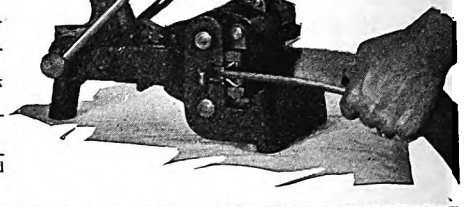
Now, having disposed of his minor inventions, we have a clear track for following Mr. Ives' lifelong work on color photography and color-printing, the latter of which at least has had important industrial and artistic results. On the former he is working toward results which he believes will transcend in universal interest anything he has ever done. Research in "heliochromy," "sun-coloring," goes back well into the nineteenth century. Some of the very earliest attempts at photography achieved it. Indeed, it was never in the mind of some of the original experimenters that the picture should be in black and white, any more than that it should be a negative: their objective was a positive in natural colors. The renowned Clerk Maxwell delivered a lecture before the Royal Institution in 1861 on color photography and illustrated it with lantern slides, one of which had taken the blue tints of the scene, another the red and a third the green. On the three slides being superposed, the resulting picture, shown with transmitted light, appeared in approximately true colors for the most part. Others made experiments, but did more theorizing, without achieving dependable

DEPENDABLE SERVICE

It is quickly becoming recognized that Detroit Belt Lacing makes the nearest possible approach to an endless belt. Greater strength, more flexibility, easier to apply, longer service, saves time, belts, power, money and annoyance—Detroit Belt Lacing is not altogether thought of as a mechanical device, but in terms of dependable service.

Hooks in Long Sections—12"—Less Waste
Opposite Points—Less Belt Perforation
Proper Proportions—Greater Holding Power
One Man Machine—Less Help
More Powerful Machines—Better Work
Unqualified Guarantee—Satisfied Users
9 Branches Carrying Stock—Prompt Deliveries
600 Jobbers—Wide Distribution

Technical information gladly given—ask for card "Right Size of Hooks"

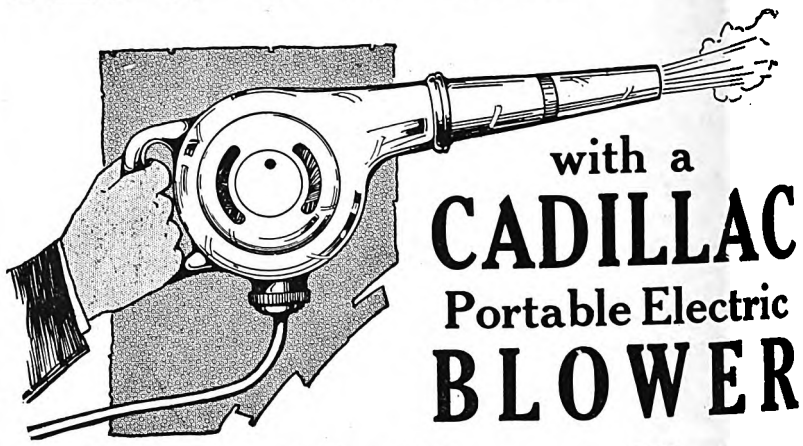


"Detroit" No. 6 Closing Machine

DETROIT BELT LACING

DETROIT BELT LACER CO.
DETROIT, MICH. U.S.A.

BLOW OUT THE DUST



with a CADILLAC Portable Electric BLOWER

Keeps Machinery Clean

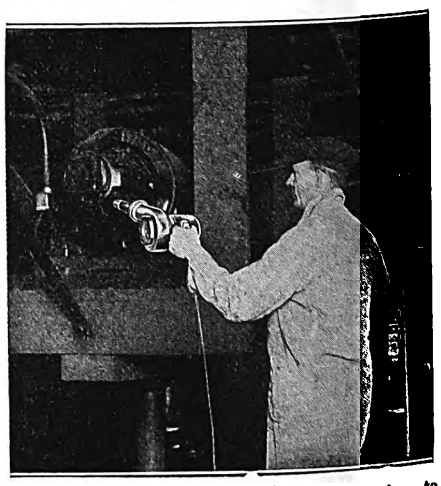
The handiest and most practical blower for blowing dust and dirt out of armatures, field coils, switchboards, machinery, line shafting, stock bins, shelves, etc. Complete in itself and requires no expensive installation or equipment.

Lowers fire risks. Makes more healthful working conditions. Reduces depreciation in electrical and other machinery.

The CADILLAC BLOWER has proved its worth and is performing successfully with hundreds of uses in shoe factories, cotton mills, grain elevators, coal mines, engravers, printers, wood working plants, textile mills, box factories and every line of industry.

Write for descriptive folder giving prices and testimonials by leading manufacturers.

CLEMENTS MFG. CO.
Manufacturers of the
Cadillac Electric Vacuum Cleaner
612 Fulton Street CHICAGO
Canadian Factory: 76 Duchess St., Toronto



Cleaning small motors. No condensation to short circuit motor and no excessive pressure to injure windings or insulation.

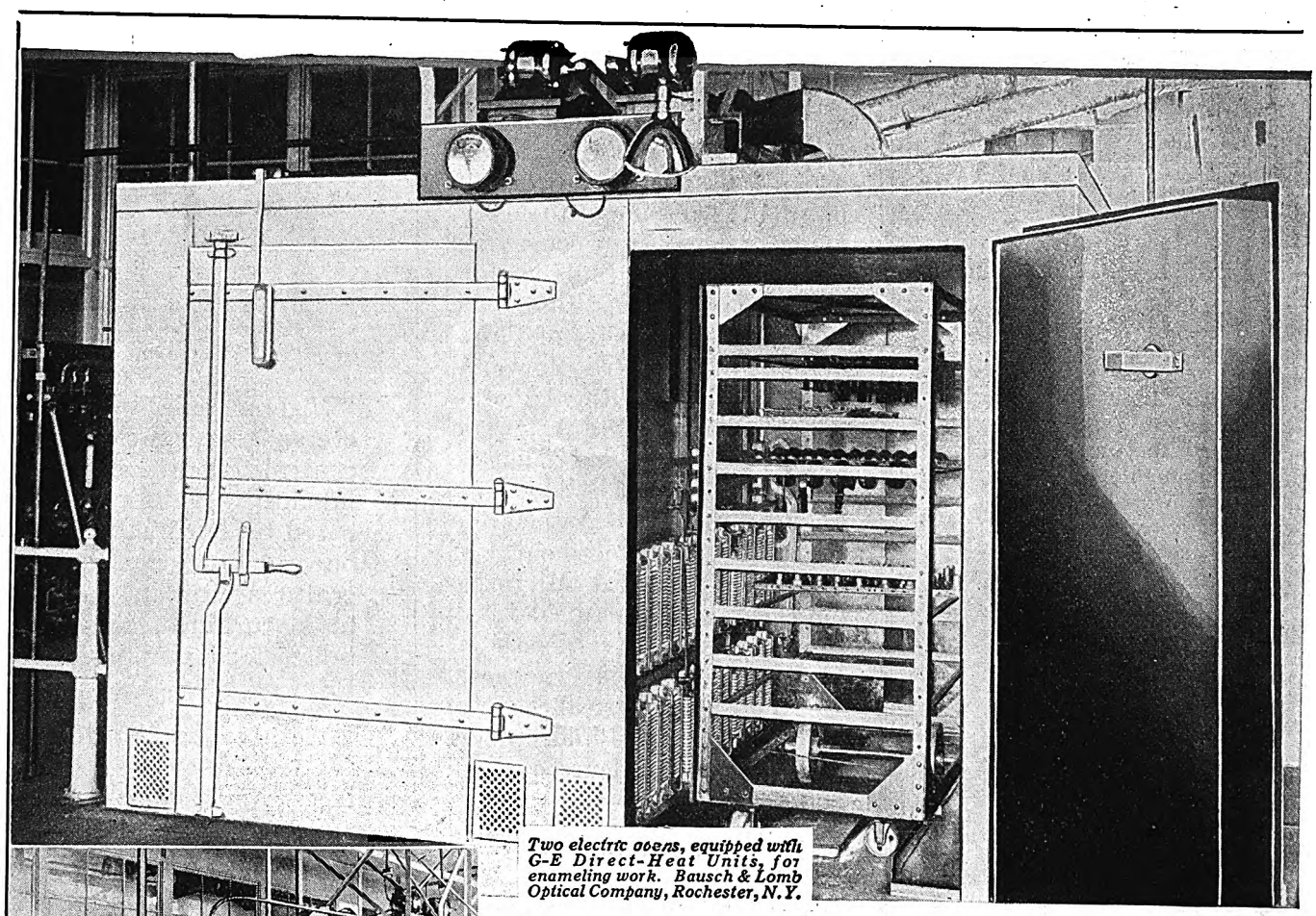
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results. But Ives, who did his theorizing in his laboratory as a basis of experimentation, was able, in February, 1888, to photograph the spectrum in its true colors and brilliancy. Before the end of the year he had progressed to where he was photographing compound colors. By means of a remarkable plate, sensitized to the three fundamental colors, used in a special camera which made a triple photograph at one exposure, he produced a picture which, when placed in the kromoscope, as he called it, proved to be startlingly true to life in color and form. It is said that probably its results will not be materially improved upon, so perfect are they; but special instruments are required, the picture is small, and it must be seen by transmitted light, whereas the popular demand is for color photograph on paper. Consequently it did not develop successfully as a business venture. But, as usual, it brought honor and medals from fellow scientists and scientific societies.

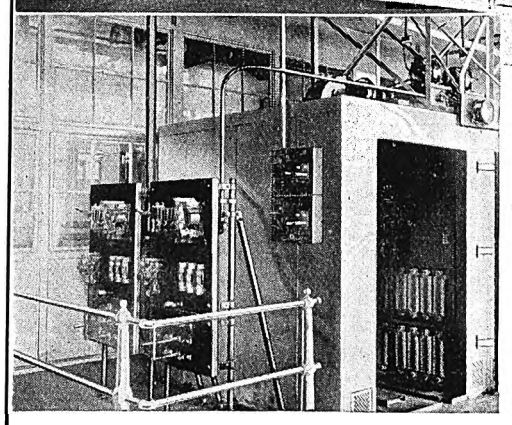
His discoveries made in the course of developing color photography, however, did have the important industrial result of laying the correct foundation principles for color printing. In a short time he had evolved the three-color half-tone printing process, thus giving to the printed page, with three impressions, a complete color range, practically equal to the best in lithography and without the high degree of skill and the expense required in that art. The process is so well known now to every school-boy that a description would only make wearisome reading, to be skimmed over and very likely skipped over. Our admiration now is reserved more for the speed and accurate "registration" of the printing press than for the more profound achievement which made it possible for the printing press to do such work at all. Only its every day familiarity warrants dismissing it with this brief paragraph, since actually the three-color half-tone is a great milestone in the progress of that art which is the great disseminator of knowledge and culture.

All along, with the study and solution of the greater problems, Mr. Ives has perfected his tools, inventing and patenting incidental improvements to the mechanism of his art. Now it is a plate-holder, again it is a special camera. Then there is a film pack, an improvement in film, a reflector for use in taking microscopic photographs. Three-color photos by the Ives process can be taken with the Ives hand camera.

Could such a man do all he did with photography and colors and not attempt to apply his ideas to the motion picture? In 1916 he was granted a patent for motion picture apparatus and another two years later. Nineteen-nineteen saw him projecting motion pictures in their natural colors; what he calls "real" colored pictures not hand-painted or otherwise doctored, but with the color in the photograph, the film itself. Two negatives are taken in two cameras through a di-chromatic screen which is puzzling to the layman, since it transmits red light to one film and reflects green light to the other film. This apparatus is another Ives product which



Two electric ovens, equipped with G-E Direct-Heat Units, for enameling work. Bausch & Lomb Optical Company, Rochester, N.Y.



G-E Automatic Temperature Control for electric japanning ovens. Bausch & Lomb Optical Company, Rochester, N. Y.

Electric Heat Reduces "Rejects"

These electric japanning ovens, equipped with G-E Direct-Heat Units and Automatic Temperature Control, have reduced the number of "rejects" from 50% of the total amount of parts formerly baked in fuel heated ovens to 4% of the same total material now baked electrically.

This in itself is an appreciable saving, but there are other economies based on the high quality of the finish and the increased volume of work which must be accredited to G-E Direct-Heat Units—for they supply heat directly to the charge with an intensity that is perfectly applied and controlled.

G-E Direct-Heat Units are easily installed on large or small japanning ovens—and their flexibility makes possible the most desirable location of each individual heating unit.

G-E Industrial Heating Specialists will gladly make recommendations covering the installations of electric heating equipment for many heating processes in your plant.

General Electric Company
Schenectady, N. Y.
Sales Offices in all large cities

GENERAL ELECTRIC

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awaits commercial development and exploitation. (Now imminent.)

Most of us can spend the better part of a lifetime learning what there is to know about some one object, how to make it or how to sell it. The Ives mind, on the extreme contrary, not only gives birth to the hitherto unknown, but is so fecund that it can come pretty near abandoning some of its progeny, at least can leave their thorough development to a later time or other hands. He is equally prolific as a medallist, so that very likely he could lose some of them and not miss them. They come from his home city of Philadelphia, the Franklin Institute, the Photographic Society of Philadelphia. They are showered upon him by the Royal Photographic Society, the American Academy of Arts and Sciences. Memberships and fellowships, too; the American Association for the Advancement of Science, the Royal Microscopic Society, the Medical Institute of Graphic Arts, National Institute of Social Sciences, the American Physical Society, the American Philosophical Society, the Academy of Arts and Sciences and others.

The voluntary establishments of standards of quality in industry forms the subject of a pamphlet which has just been printed by the Fabricated Production Department of the Chamber of Commerce of the United States.

There has been a growing interest for some time in the establishment of quality standards, says the department, which calls attention to the fact that a recent canvass of trade associations discloses that many have set up standards and that still others have provided guarantees of quality in backing up the products of their members.

"Quality and quantity standards," says the pamphlet, "are essential for the free interchange of commodities in commerce beyond the stage of first-hand transactions in which personal observation and opinion govern. Progress in civilization is measured by commerce, so standards are at the base of civilization as well as of commerce."



No. 644 Gauntlet Glove, reinforced with flexible steel ribbons clinched over strips of tough leather. Extra leather patch on the thumb. $18.00 per dozen pairs.

Less Labor Turnover with Hand Protection

Try a few pairs of Steel-Grip Industrial Gloves. You can hardly realize how well they are made—how thoroughly they protect the workers' hands and give them added assurance of hand protection.

STEEL GRIP
MADE IN CHICAGO

Industrial GLOVES

are especially made for industrial use for men who handle castings and other rough materials in shops, foundries, mills, scrap yards, mines or smelters.

They are built up of three wearing surfaces and a comfortable felt lining—flexible steel ribbon reinforcement clinched over tough strips of leather and strong steel thread stitching. No danger of seams ripping, burning or tearing out.

Steel-grips will help in lessening labor turnover.

Our catalog describes the complete line with suggestions for the proper gloves for the various requirements. Send in your order for a dozen pairs on trial and the catalog.

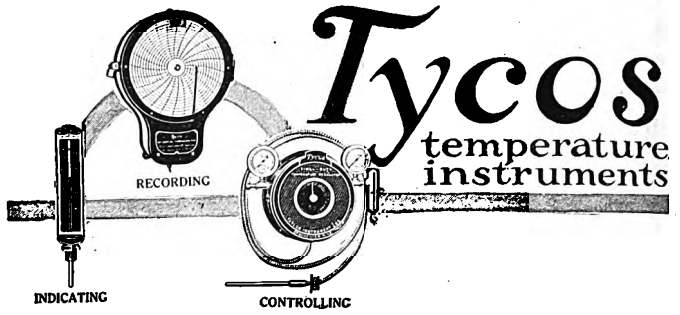
INDUSTRIAL GLOVES CORP.

1201 Fullerton Ave. Chicago

Try a dozen Pairs



No. 605 Short Glove, steel ribbon reinforcement and extra wearing patch in palm. $16.00 per dozen pairs.



Tycos
temperature instruments

A LETTER WORTH READING

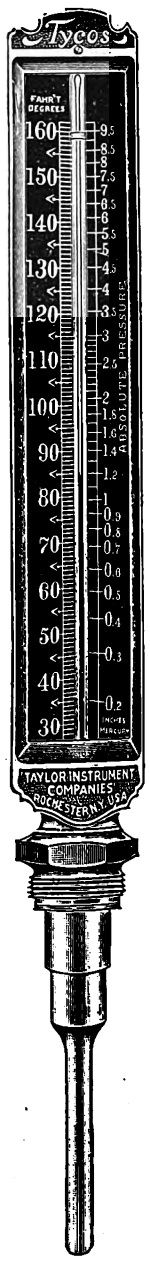
This letter was written by the efficiency engineer of one of the largest and latest modern power plants in this country.

"We bought 152 of them"

"Without reliable indicating thermometers, the efficient operation of a central station is impossible. Our confidence in *Taylor* instruments is indicated by our installing 152 of them in our power station for indicating temperatures vital in the operation of the main turbines, condensers, hot wells, boiler feed pumps, oil coolers, transformers, etc.

We have just installed a 60,000 K. W. 3 element, cross-compound turbo-generator, which is one of the largest units in the world. The outstanding variable affecting the efficient operation of this unit is the vacuum. The *Taylor* instrument has been chosen for the important work of indicating the vacuum on this tremendous unit, which uses so much steam that a reduction of 1% in its efficiency means a loss of about 6,000 lbs. of steam per hour.

"The 2 instruments indicating vacuum have 2 scales, one for absolute pressure in inches of mercury, the other for temperature in degrees Fahrenheit. This dual scale is a great convenience. While it is impossible to prove increased efficiency due to these indicating instruments, it should be perfectly obvious that the important processes in this plant could not be properly controlled unless the situation was constantly shown by reliable instruments. We would not consider designing a plant without including such equipment."



A copy of this letter containing the writer's name may be obtained by referring to this advertisement.

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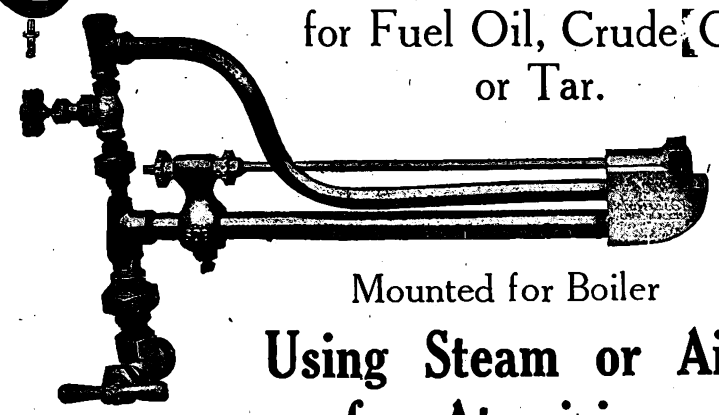
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There is a *Tycos* or *Taylor* Temperature Instrument for every purpose.

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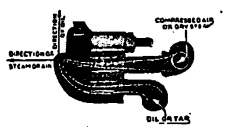
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Using Steam or Air for Atomizing



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Note direction of arrows. The air or steam meets the oil at right angles, thus thoroughly atomizing the oil externally. This prevents *Clogging or Carbonizing.* The burner is always clean.

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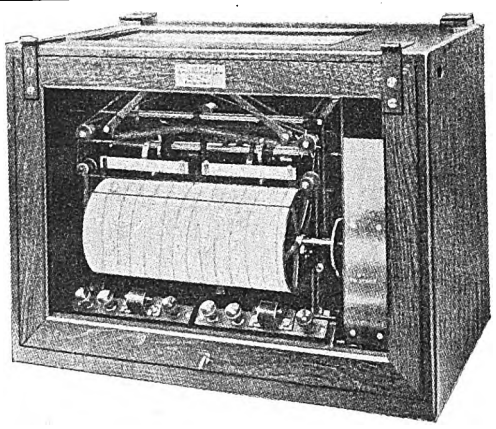
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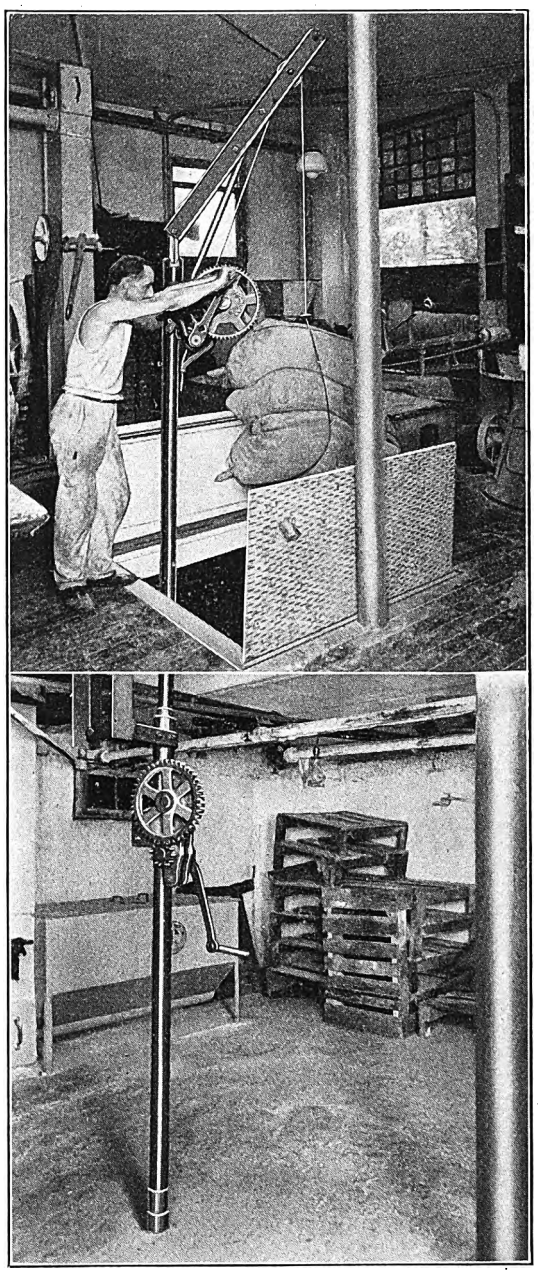
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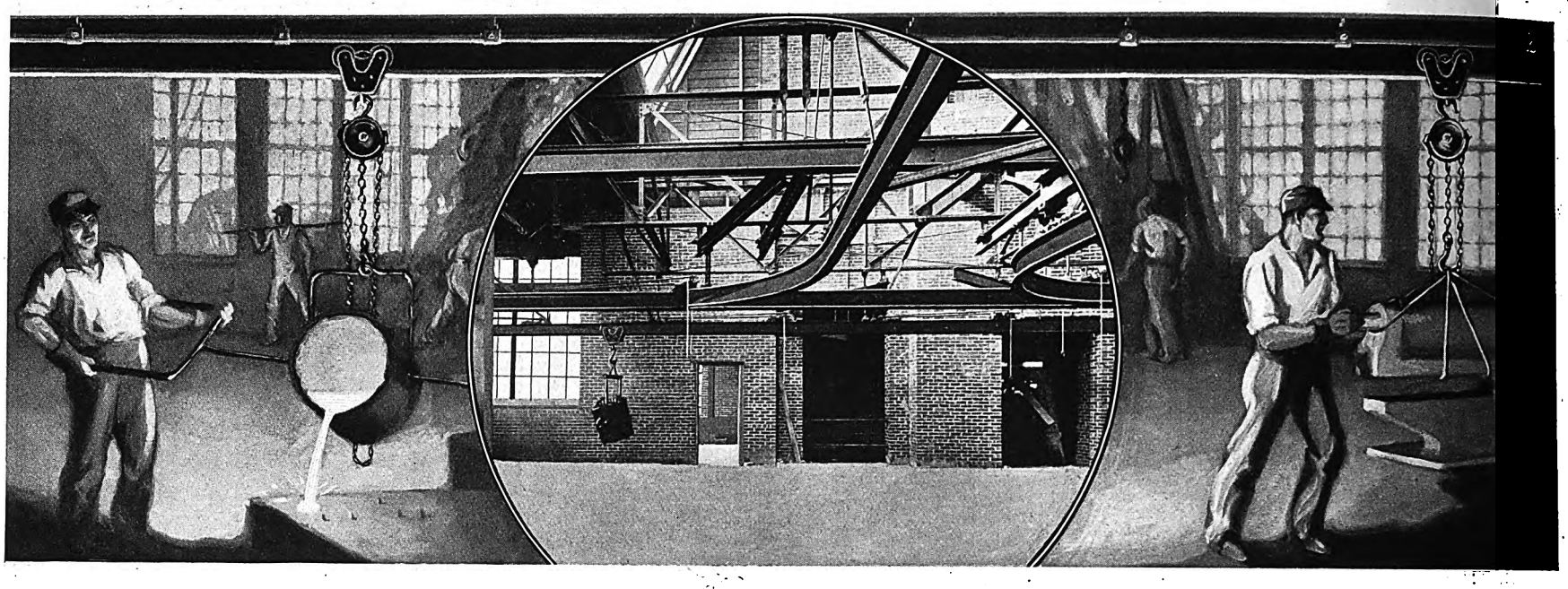
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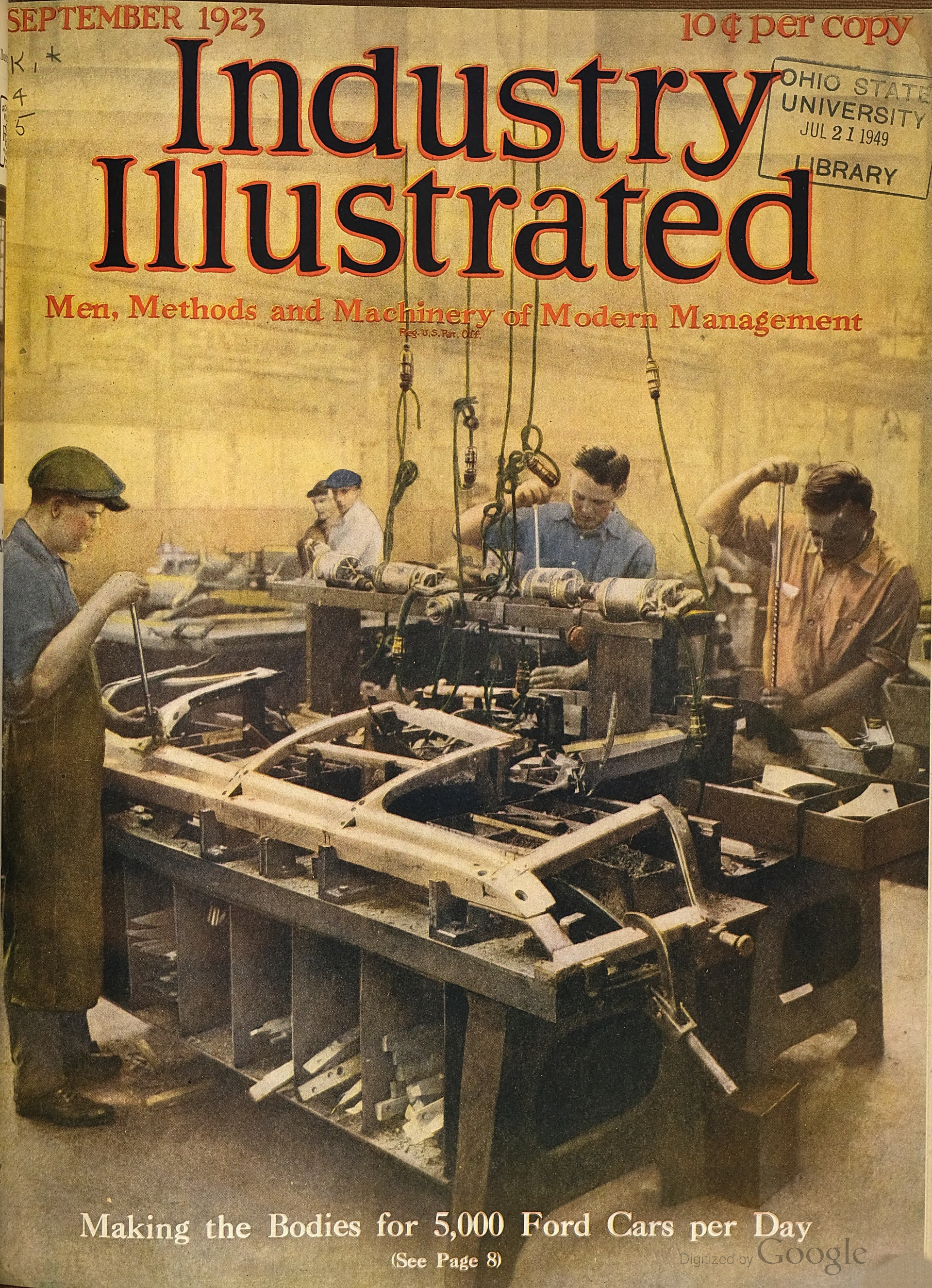
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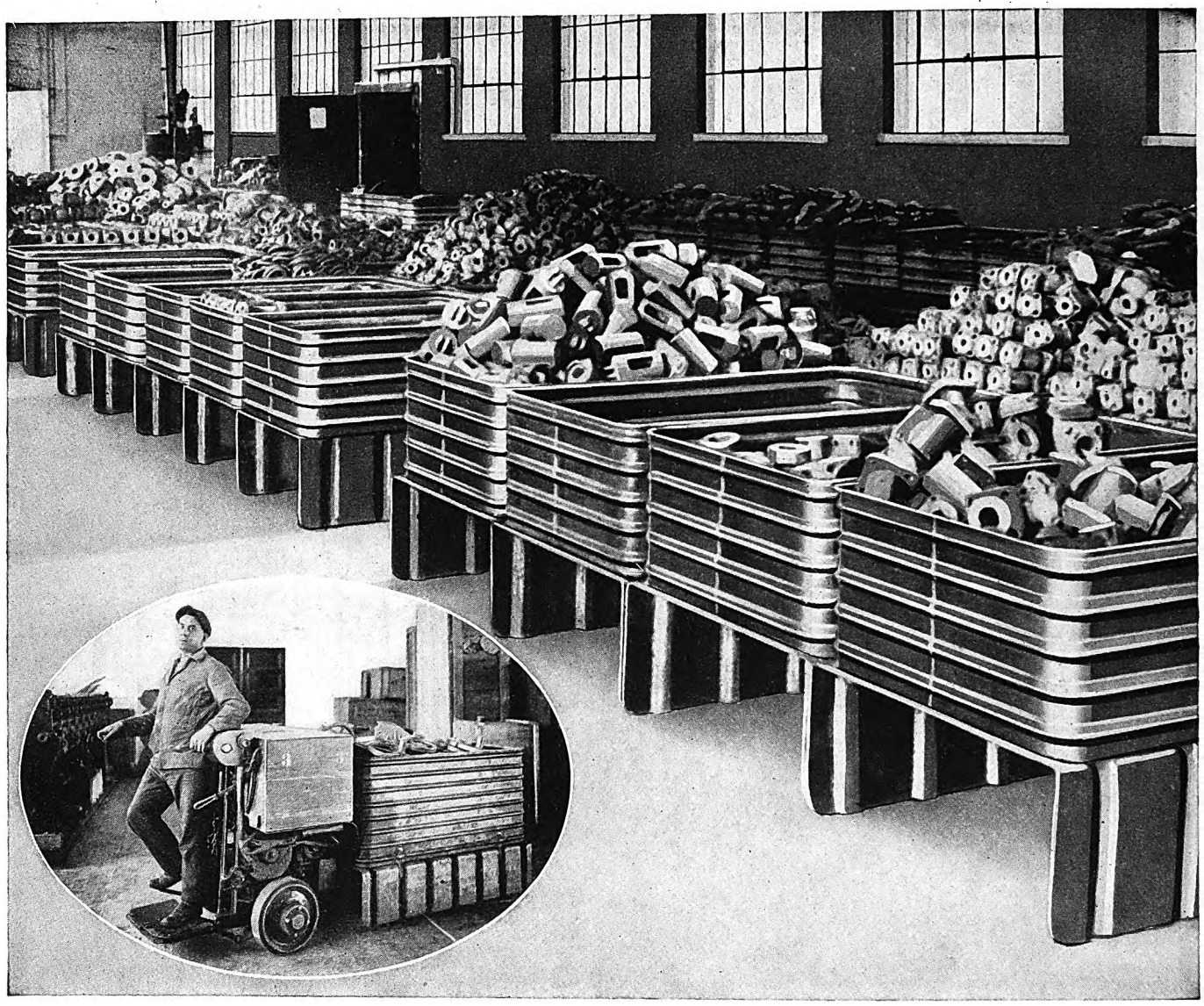


Making the Bodies for 5,000 Ford Cars per Day

(See Page 8)

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TRUSCON Alloy Steel Platforms and Boxes keep your material off the floor and make it cost less to handle the production of each machine in your shop.

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Get full information. Tell us your needs and we will gladly furnish suggestions and estimates

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TRUSCON ALLOY STEEL PLATFORMS AND BOXES

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Industry Illustrated

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On page 54 will be found a list of those concerns to whose courtesy we are indebted for photographs in this issue not otherwise credited.

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Construction Work on the Hetch Hetchy Dam

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For Speed—The Link-Belt Crawler Crane

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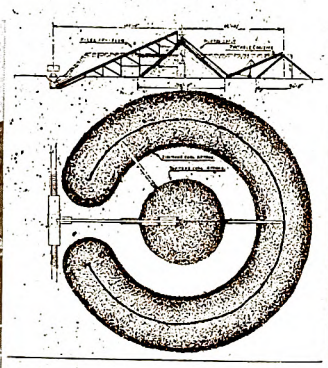
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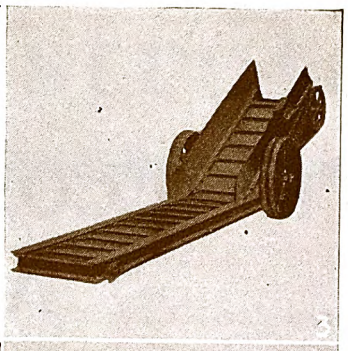




1—One man has handled 500 tons of coal per month since the Barber-Greene Portable Conveyor shown in this photograph was installed. Note that the Barber-Greene Portable is here used as a fixed unit.

2—A Barber-Greene coal handling engineer's solution of a troublesome storage and handling problem.

3—A new Barber-Greene Feeder for unloading coal without constructing a pit beneath the tracks.

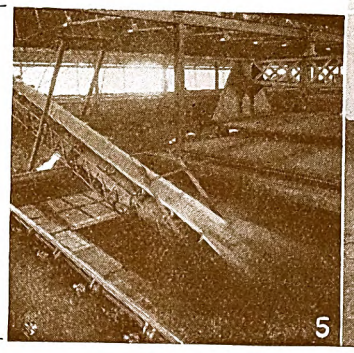




4—Where two Barber-Greene Conveyors enable two men to handle 4000 tons of coal per month the year 'round.

5—Barber Greene Conveyor installed in a gas plant in Manchester, England, doing dirty, heavy work more economically and with less trouble than men alone could do it.

6—Loading cinders with a Barber-Greene Bucket Loader.





Make Machines do the Dirty Work

Saving money and trouble

The direct saving shown by Barber-Greene Portable Conveyors and Bucket Loaders is, of course, the strongest factor among many that lead employers to prefer them to shovel gangs. But the tendency of labor to leave the dirtier jobs whenever opportunity offers, and the resulting petty disorganization, have led many companies to install this equipment who otherwise—probably largely from force of habit—would have been blind to the economies it effects. The illustrations and descriptions at the top of this page show a few of the many applications that Barber-Greene coal handling engineers have devised at the request of organizations who wished to minimize the amount of troublesome dirty work in their plants. These engineers have solved a great variety of coal-handling problems and are thoroughly conversant with all standard, and many special, types of coal storage and handling layouts. Their success in solving dirty-work problems with Barber-Greene equipment is due to the thoroughness of their training and experience and also to the superior flexibility and adaptability of Barber-Greene Loaders and Conveyors. Send for additional performance data and our catalog V.

The applications shown here

Send for application data

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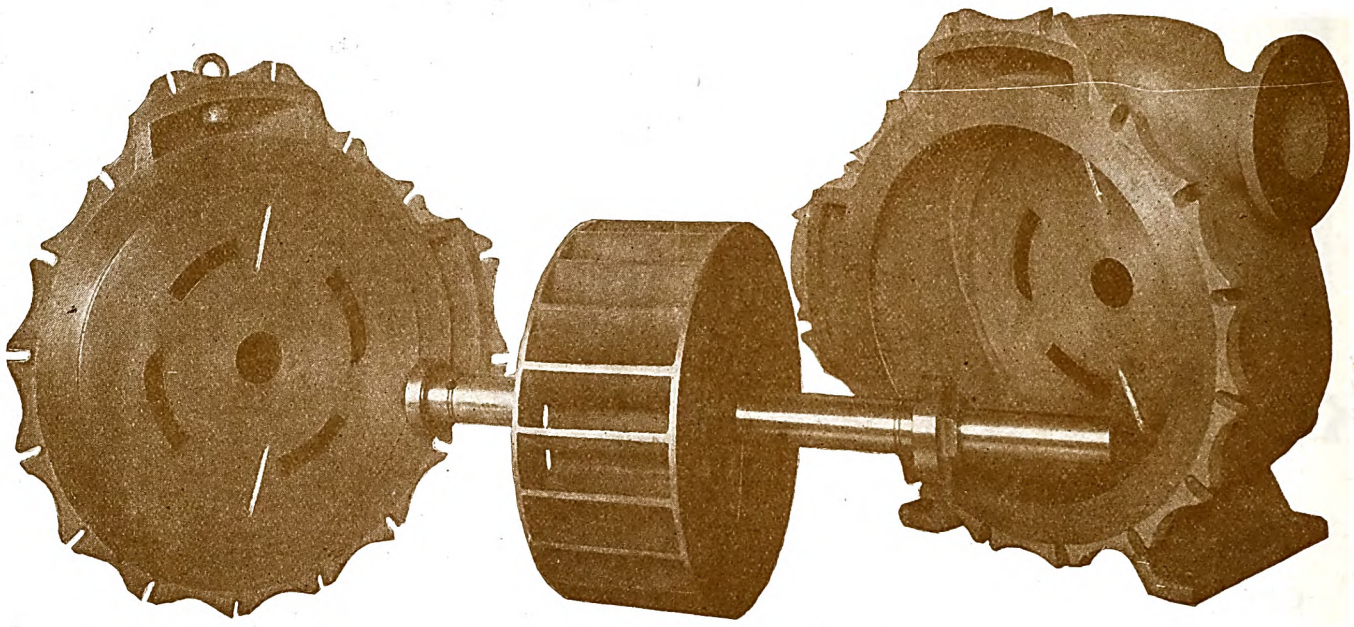
BARBER GREENE

Portable Belt Conveyors — Self Feeding Bucket Loaders

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THE ECONOMICAL AIR COMPRESSOR AND VACUUM PUMP



ALL THE PARTS OF THE HYTOR

THE HYTOR COMPRESSOR is valveless, has no gears, loose moving or reciprocating parts, no piston packing to renew, no cylinders to lubricate, and no bearing adjustments to make.

The rotor, the only moving part, is cast in one piece, the blades being rigidly reinforced by shrouds. The rotor is mounted on a short, stiff shaft supported at each end by the highest grade annular ball bearings mounted outside of the casing.

As the peripheral clearance is large, there is no possibility of the ends of the rotor blades coming in contact with the casing.

The original high efficiency is maintained indefinitely in continuous service.

The air is thoroughly washed during compression and contains no oil.

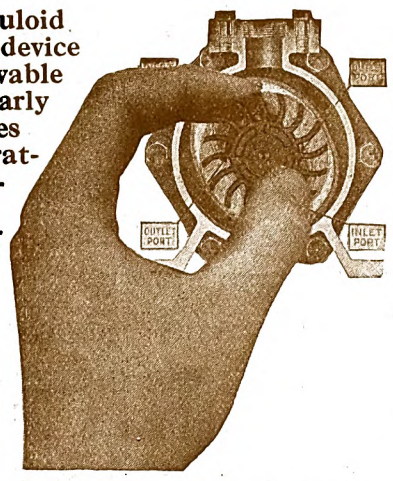
Hytor compressors occupy very much less floor space and are much lighter in weight than reciprocating compressors.

They run without vibration.

The cost of installation is greatly reduced as no expensive foundations are necessary.

No expert attendance is required as there are no adjustments to make. The cost of upkeep is negligible.

Hytor compressors are quiet in operation.

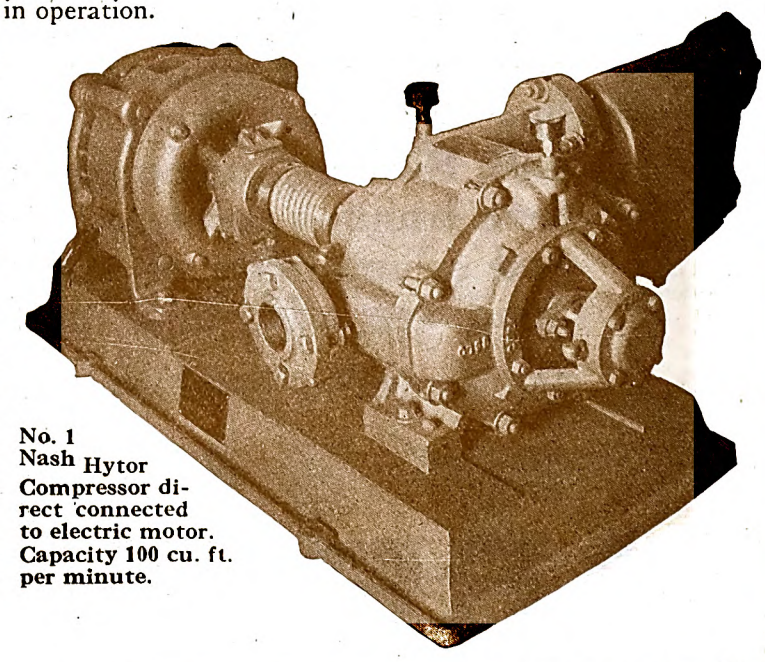


This celluloid graphic device with movable rotor clearly illustrates the operating principle. Send for your copy.

At pressures up to and including 15 lbs. per square inch, and vacuums up to 20 inches of mercury, the Nash Hytor affords the simplest and most economical means for handling air or gas, for all of the usual purposes where air under pressure is required, and they can be used on many special services for which the ordinary compressor is not adapted.

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No. 1 Nash Hytor Compressor direct connected to electric motor. Capacity 100 cu. ft. per minute.

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Industry Illustrated

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EDITORIAL

What is Coal Worth?

AS this editorial is being written, the nation is faced by the very real threat of a strike in the anthracite coal fields. By the time these words are in the hands of our readers, the threatened strike will either be an actuality, or else some as yet undiscovered ground for compromise will have been reached.

The idea of a coal strike is not new; in fact, it bids fair to become perennial. So far as the general public is concerned, the only tangible result of last year's strike—aside from a modicum of real hardship and a great deal of inconvenience—is that coal prices to the consumer remain higher than the general commodity price level would seem to warrant.

No fair-minded student of industrial history would pretend that all strikes are unjustified. There have been in the past many cases where employer injustice and abuse of power made a strike the only possible recourse. It is none the less true that, broadly speaking, strikes and lockouts are in the same category as war: none of them ever results in an economic gain to any participant commensurate with the cost. If, for example, a man goes on strike for five months, and thereby gains a twenty per cent. wage increase, it will take more than two years at the higher wage to repay him in money for the wages lost while on strike.

The whole vast business of the mining and distribution of our coal is so intricate, so many-sided, so full of glaring inconsistences, and so be-clouded by charges of profiteering, slackerism, lobbying and what-not, that the hundred-and-odd millions of us who are not immediately connected with the industry—but who are vitally affected by its strikes and wage agreements—cannot justly appraise the situation.

Without doubt there are some highly estimable and intelligent gentlemen among the miners, and some equally estimable gentlemen among the operators. It is highly probable that if these individuals could assume control of their respective camps a settlement would be reached in short order, and on a basis of justice to both. At the present writing, however, such a possibility seems remote.

There is one consoling thought which is too seldom dwelt upon; consoling, at least, to that great, voiceless body of ultimate consumers who always pay. And that is the old adage that necessity is the mother of invention. Already, as a result of last year's experience, many anthracite coal consumers have learned to use substitutes—coke, oil, and cheaper grades of bituminous. Moreover, there has been deeper study of the question of preventing heat wastes by proper insulation. Many domestic consumers of anthracite coal have found that attention to this neglected detail resulted in making seven tons of coal do the work formerly requiring ten tons. And the high cost of coal has also helped to stimulate interest in the development of water power resources.

If the long-drawn-out and just celebrated coal controversy lasts for any great length of time, the participants may some day awaken to the realization of an age-old truth: That any commodity, once its cost passes the bounds of reason, beecomes unmarketable.

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Making Bodies for Ford Cars

First Pictorial Description of an Amazing Industry

By John H. Van Deventer

ALL of the body parts for the entire American output of Ford cars, with the exception of the coupe, are fabricated in the B building at River Rouge. In itself, this body work constitutes an industry employing over 6,000 men, in spite of the fact that comparatively few bodies are completely assembled in Detroit. For the Ford policy is to decentralize body assembly, to ship carload sets of "knocked down" body parts to the various assembling plants located throughout the United States. In these branch plants the bodies are assembled, painted and fitted to the chassis.

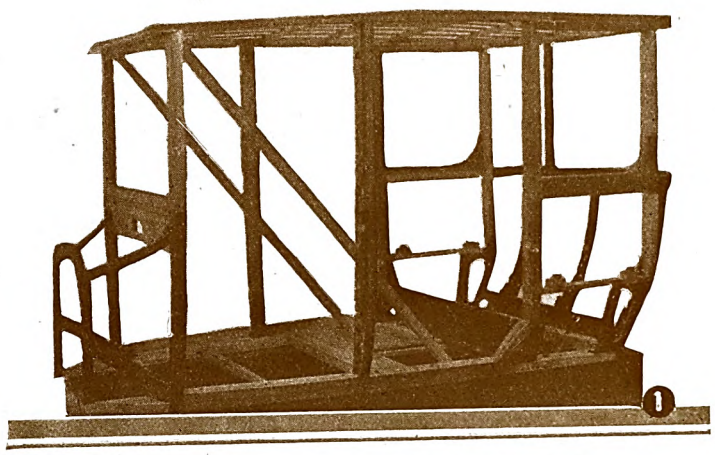
A system of this sort is made possible only through the evolution of a highly standardized body design, particularly adapted for quick and simple final assembly.

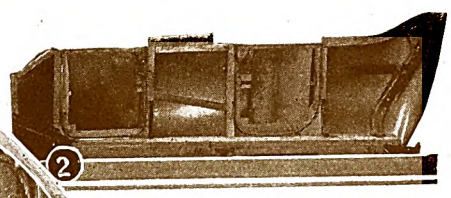
What one finds in the body plant at River Rouge today is a carefully specialized and highly integrated process of manufacture whereby sheet steel and hard wood are transformed with almost confusing celerity into "knocked down" body parts.

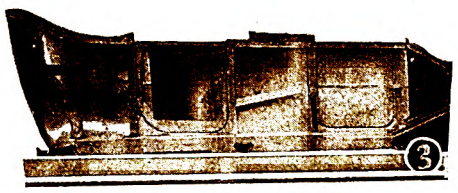
Roughly speaking, and for purposes of description, the process of body part making divides itself into four parts:

1. Sheet metal stamping and forming.
2. Wood part sawing and fabricating.
3. Framing, paneling, door hanging and fitting.
4. Shipping.

The sheet metal operations occupy possibly 25 per cent. of the total floor area devoted to body work. The heavy presses are located on the ground floor under the mezzanine on the eastern side of the northern half of the B building. The lighter presses for small sheet metal parts are located on the mezzanine immediately above. The sheet metal arrives in cars near the eastern wall of the building. From temporary sheet storage piles just inside this wall the work flows from east to west through various progressive "line ups" of presses, emerging at the cen-







Figs. 1, 2 and 3. Above is the wooden skeleton of a Ford four-door sedan before the metal panels are applied. Below are the right and left-hand sides of the touring car body.

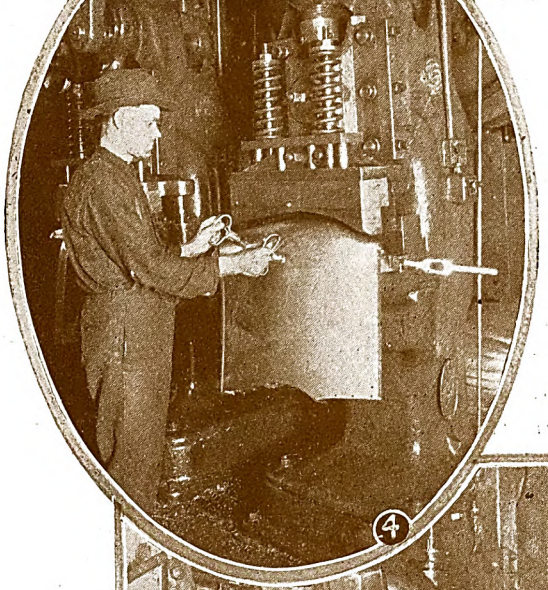


Fig. 4. Safety in handling sheet metal work in the presses is a first consideration. The picture on the left indicates this.

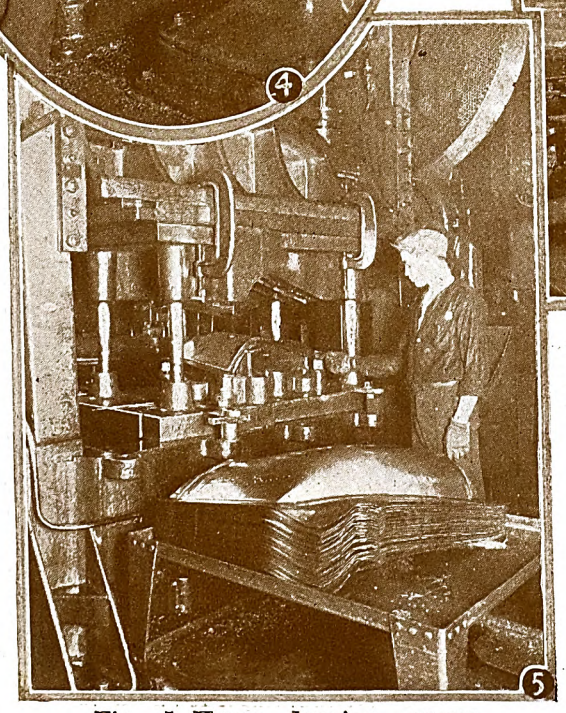


Fig. 5. Heavy drawing presses form the curves in the body panels.

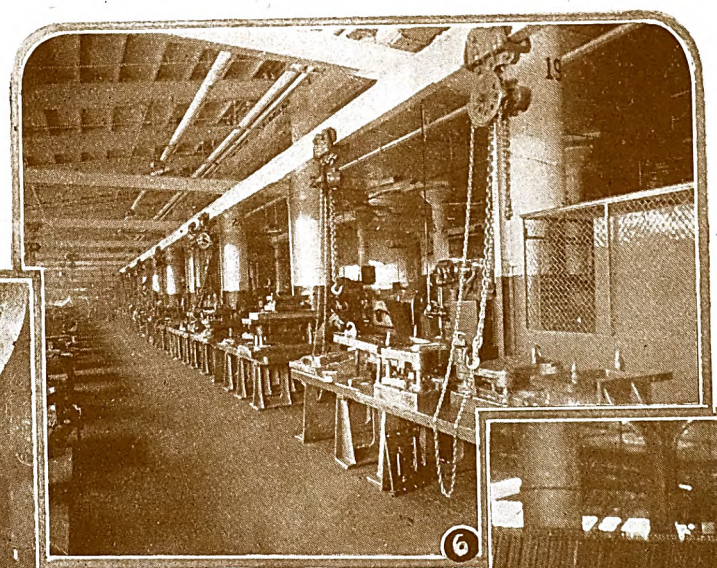


Fig. 6. To keep the complicated dies in proper condition a large tool repair and maintenance department is required. One view of this is shown above.

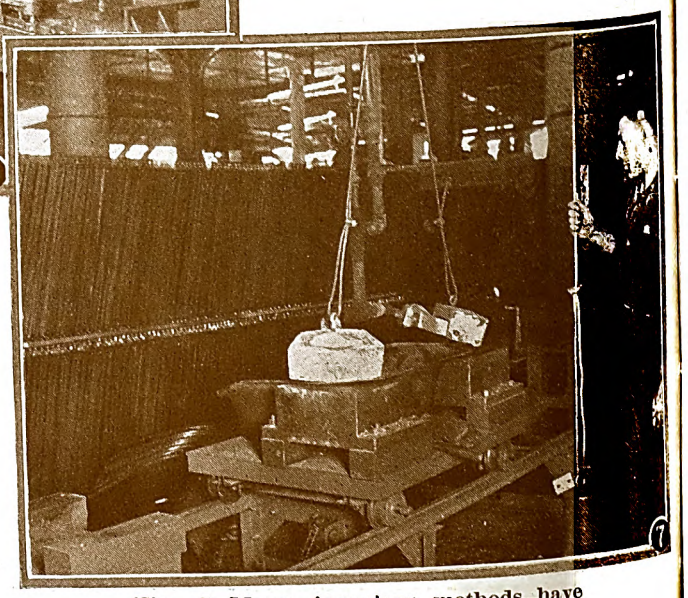
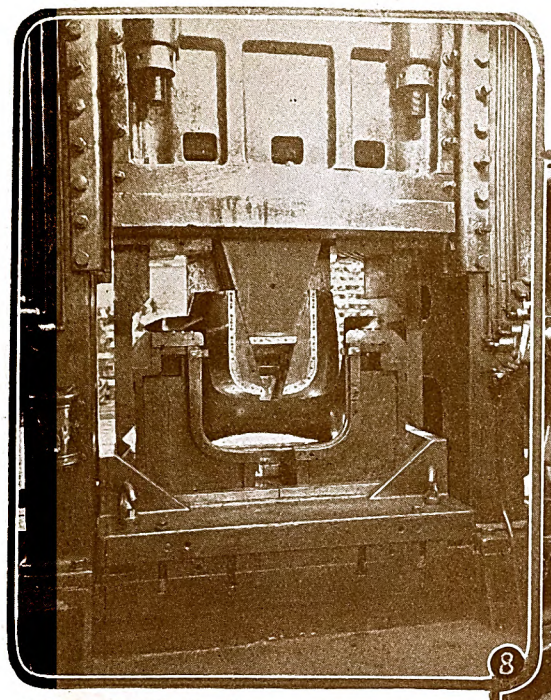
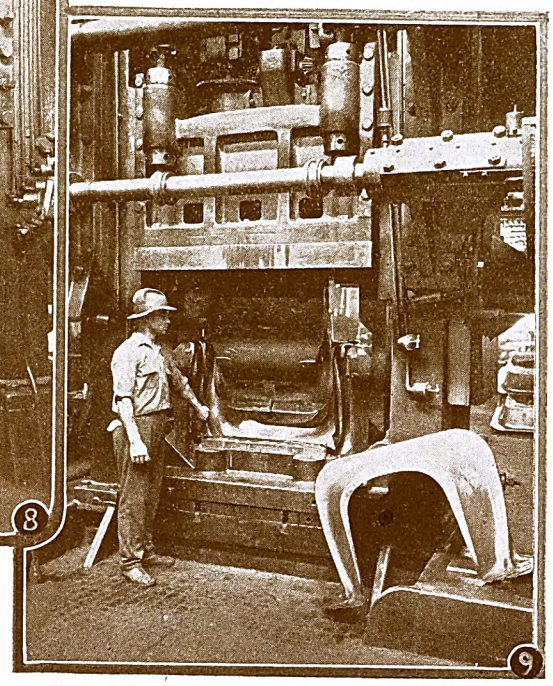


Fig. 7. Many ingenious methods have been worked out to aid sheet metal production. Here, for example, cowl corners are being heated before dinging.

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Figs. 8 and 9—Above and at the right are shown two views of the huge drawing press which forms the sedan cowl in one piece.

tral bay in finished form. Here such parts as are now complete without the addition of woodwork are made directly into sets for shipment to the branch assembling plants. Panels and other parts requiring framing are lifted by crane to the assembling mezzanine on the west side of the building.

Hardwoods arrive in various forms, kinds and sizes, both in logs and rough sawn. After kiln drying, this stock proceeds to the gang saws that are located on the ground floor under the west mezzanine at the northern extremity of the plant. Operations on the sedan woodwork progress from north to south on the ground floor level. Operations on the touring car body wood parts take place on the western mezzanine immediately above and

Fig. 10. Below is a view in the central bay in the body plant showing cars ready to be loaded.



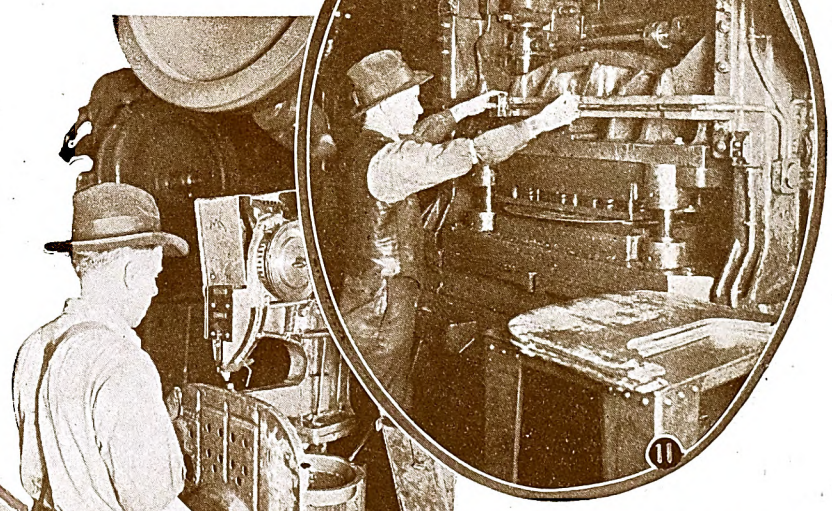


Fig. 11. Safety buttons are provided on each press so that the stroke cannot be commenced while the operator's hands are in danger.

Fig. 12. Here is the final operation on the all-metal cowl, namely, stitching on the bracket for the radiator tension rod.



Fig. 13. Here is shown an operator putting a stamping into one of the big presses. Note how his hands are kept from between the dies.

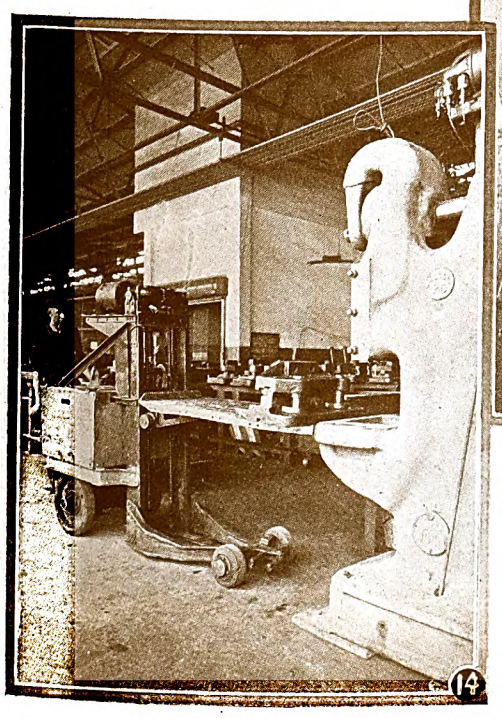


Fig. 14. At the left is shown the method used in transporting dies at River Rouge, the lift truck elevating them to the level of the press platen.

also progress in the same direction. The framing and paneling of partial assemblies for "tour car" parts are done on this same mezzanine, the progression also being from north to south. Completed assemblies are brought by conveyor and otherwise down to the ground floor level to the center bay which at present is the car loading station. Plans are being now made to completely conveyorize this transportation. This will include the installation of finished stock conveyors running to car loading platforms outside of the building, doing away with the necessity of employing valuable crane-served floor space for car loading and thus permit-

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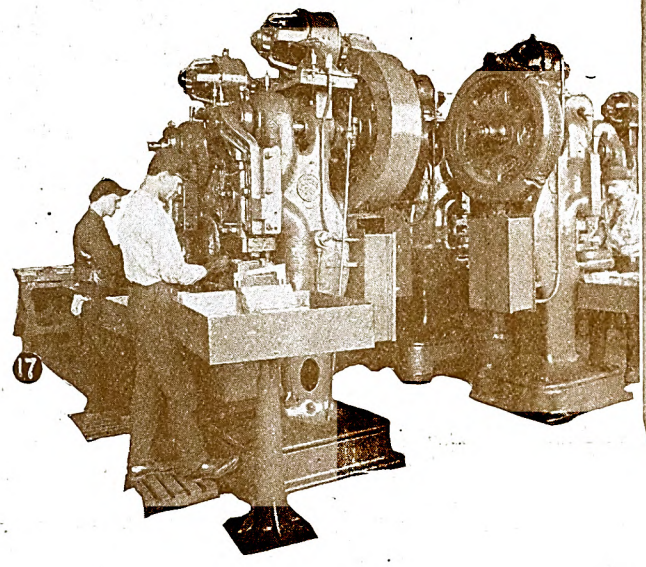


Fig. 17. Below is a view of the hinge press line-up. Each touring car requires six hinges.

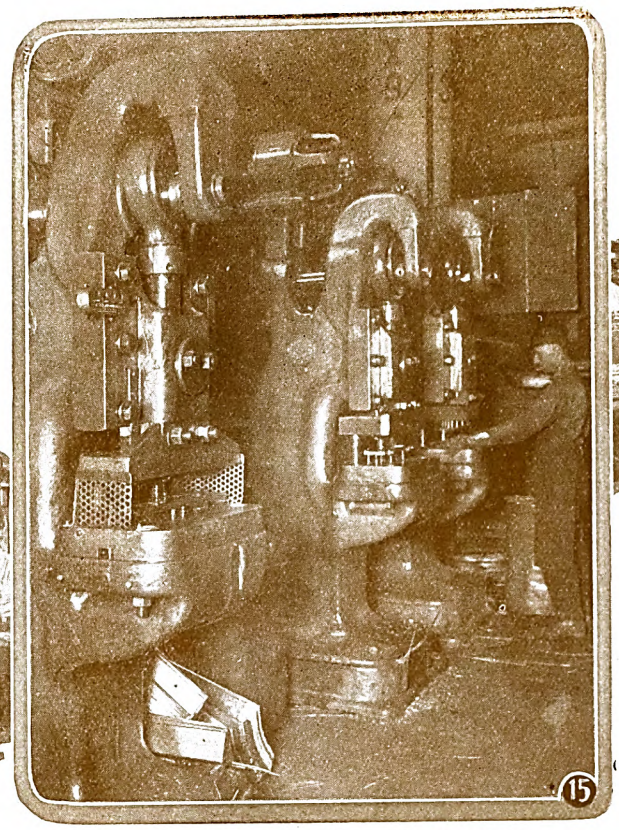


Fig. 15. One of the battery of waste utilization presses which is arranged alongside of each principal production line-up. Here scrap is worked up into usable parts.



Fig. 16. This shows the making and assembly of touring car door hinges.

ting this area to be used for heavy press work.

Along this eastern inside wall of the building are the temporary sheet metal storage piles which feed the various batteries of "line-ups" of presses which fabricate the sheet metal parts and which are arranged in distinct progressive groups running from east to west. Production on these presses is balanced so that there is practically no inter-operation storage or piling. There may, of course, be a few pieces ahead of each operator but strictly speaking they work from hand to hand, operations being so timed that it is a case of out of one press and into another without delay. Under such a system while the individual efficiency of one or two machines may suffer and their maximum output not be ob-



Fig. 19. After the scrap is baled it is raised on an elevating conveyor and dumped into box cars which take it to the foundry.

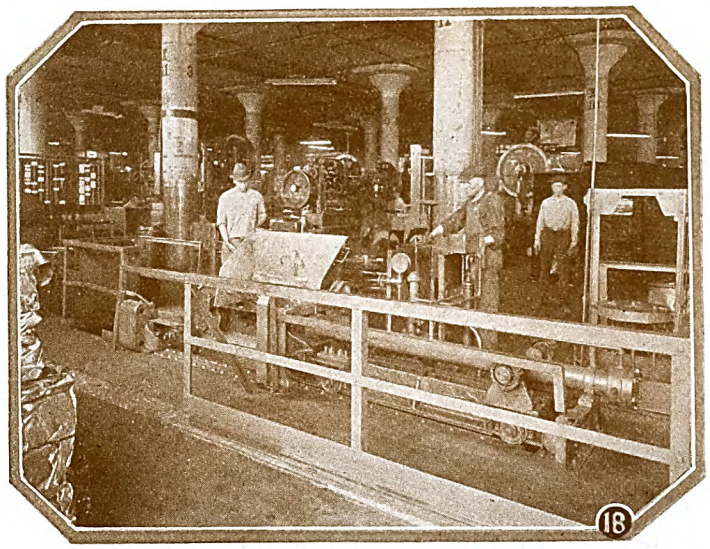


Fig. 18. Above is one of the scrap baling presses where sheet metal which otherwise cannot be utilized is pressed into compact bales for remelting.

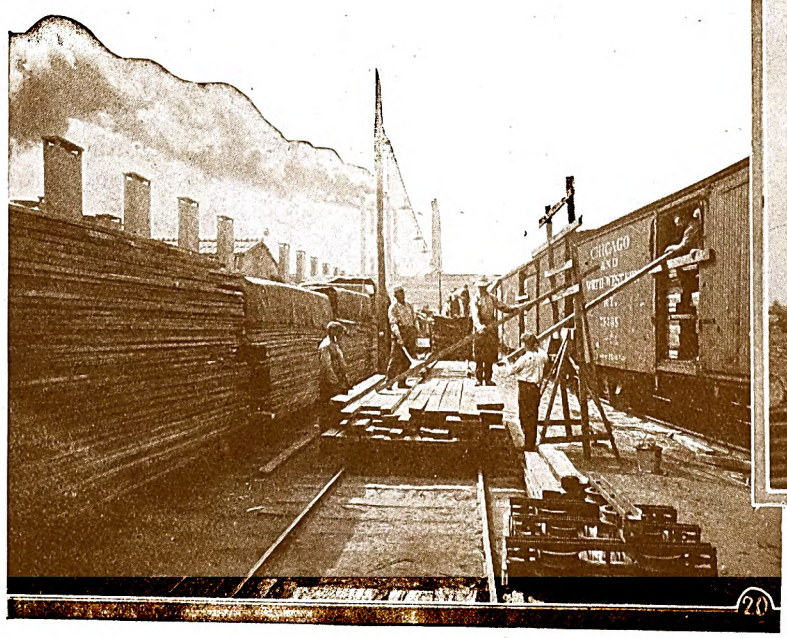


Fig. 20. At the left is a typical view in the lumber storage yard with cars being unloaded and graded.



Fig. 21. A saw mill is located at the plant although the larger portion of the lumber used comes in rough sawn boards.

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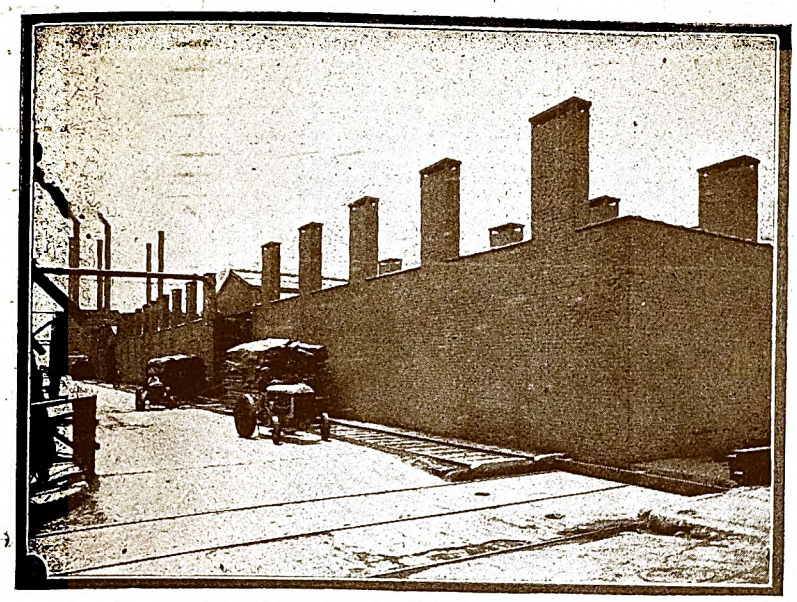


Fig. 22. Above is a view of the dry kiln through which goes the lumber to be used in Ford body production.

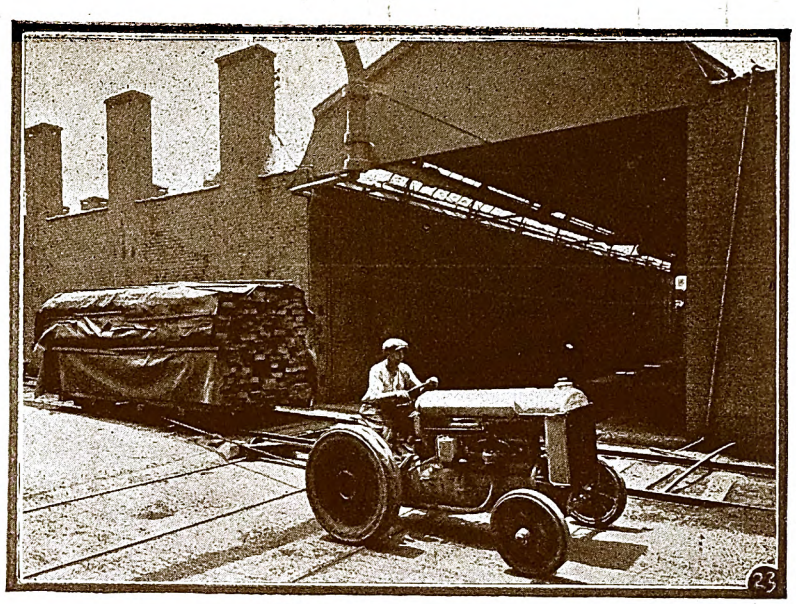


Fig. 23. Ford tractors are used to draw racks of lumber from the dry kiln to the body plant.

tained, nevertheless, the efficiency of the group which represents the total efficiency or over-all efficiency of making the part is a maximum. In most of these groups the presses are located in such manner that the press operators pass the parts from one to the other, either from hand to hand or by sliding on gravity conveyors or slippery slides Thus in the majority of "line-ups," from the time that the sheet leaves the storage pile to the time that the last operation has been completed there is no necessity for the employment of roustabouts or material handlers.

The Ford idea is to "make something" out of every bit of scrap or waste whether this be wood or sheet iron; therefore the scrap coming from the trimming of presses and blanking presses has been carefully studied to determine what Ford or Fordson parts can be stamped from it. Once this

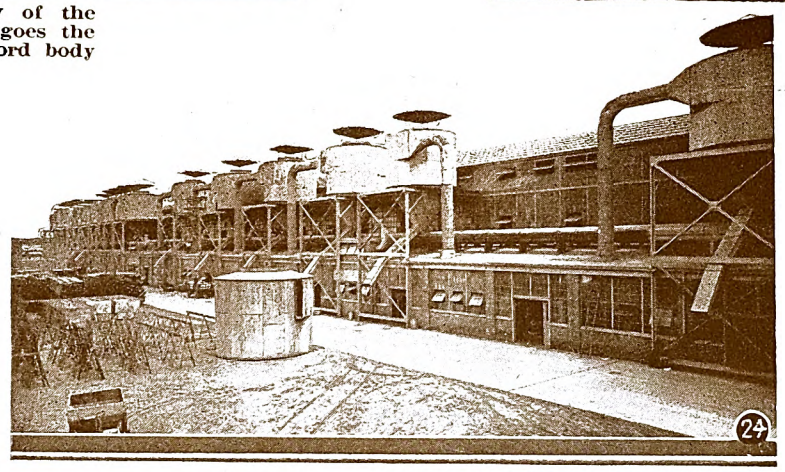
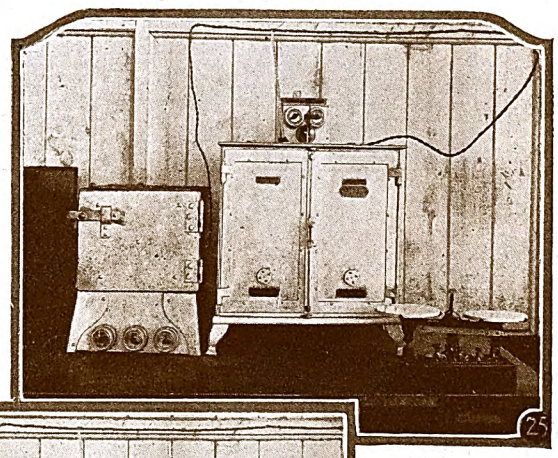
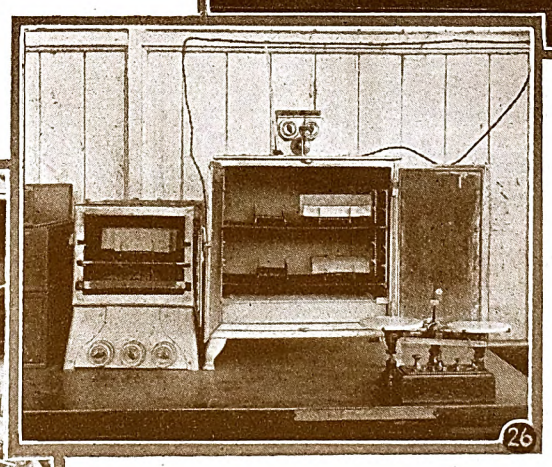


Fig. 24. An impressive array of dust collectors indicate the extensive amount of saw dust produced from woodworking operations.





Figs. 25 and 26. Above are two views of the electric baking oven used for drying samples of lumber to determine its moisture contents by weighing the samples both wet and dry.

Fig. 27. Below is the start of the fabrication of body and wood parts. The cut-off saws must be used with discrimination and judgment to insure profits.

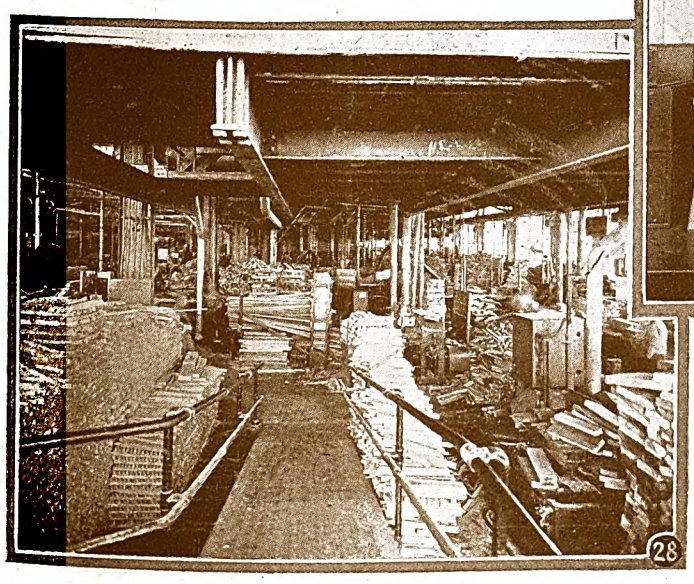
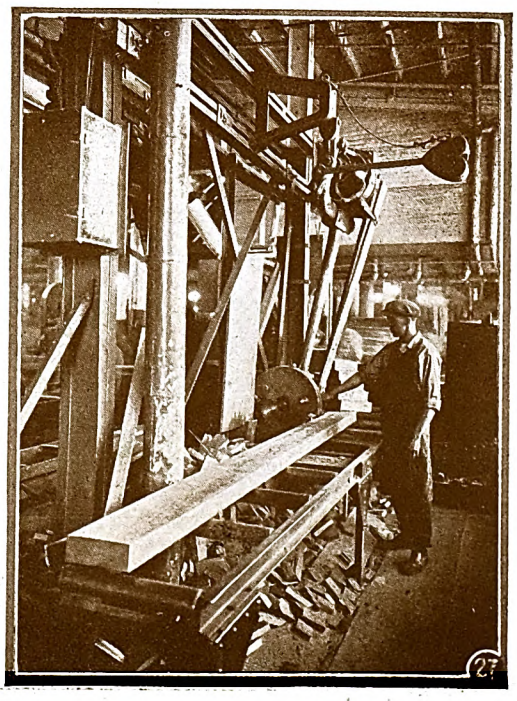


Fig. 28. A literal forest of wood parts is shown above; yet it is but a fraction of a day's requirements.



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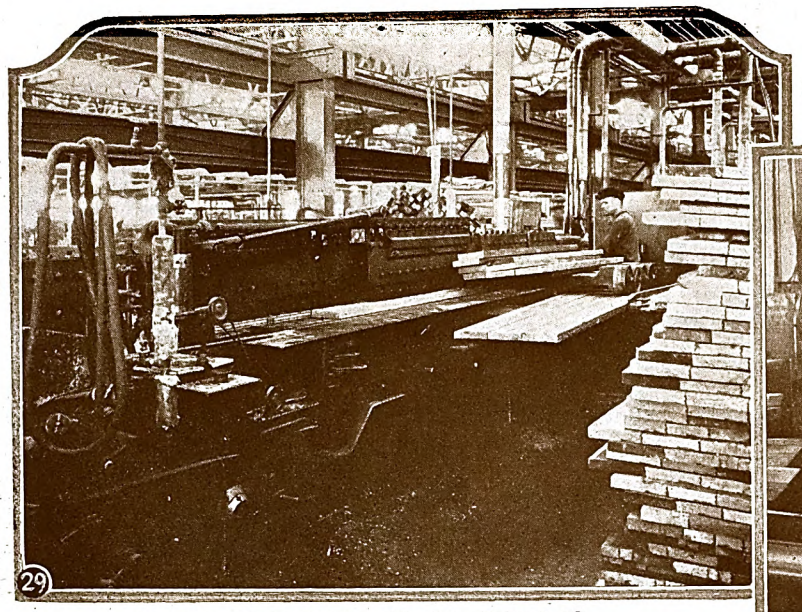


Fig. 29. For making wide boards out of narrow ones the ingenious machine pictured above serves a useful purpose. It is called a Linderman.

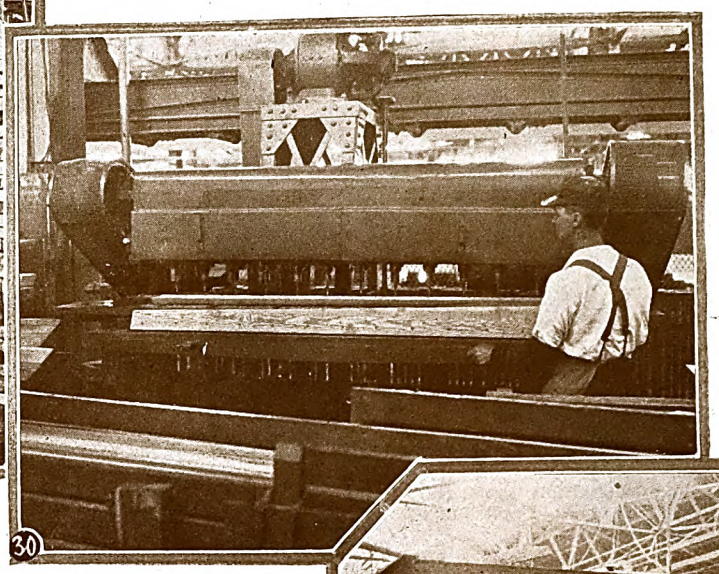


Fig. 30. One of the operations on a touring car sill is shown here. Twelve holes are bored at one time.



Fig. 31. This machine is known as a bull planer and puts the beveled surface on the side of the rail.

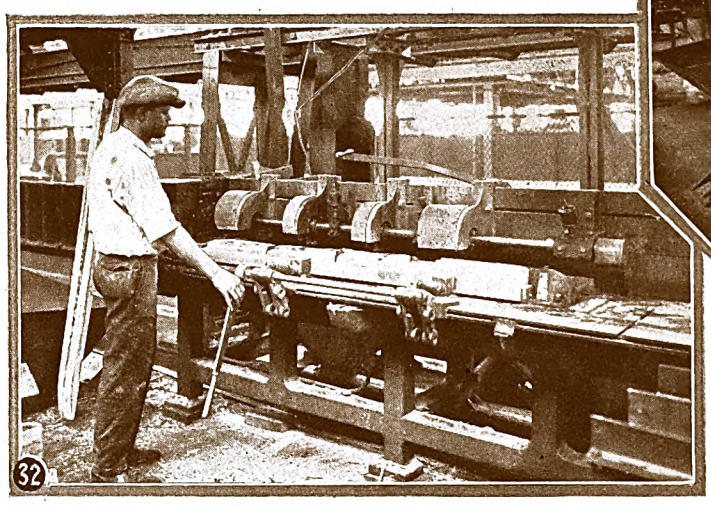


Fig. 32. At the right is shown a machine which quotes gains or cuts slots in the sill frame.

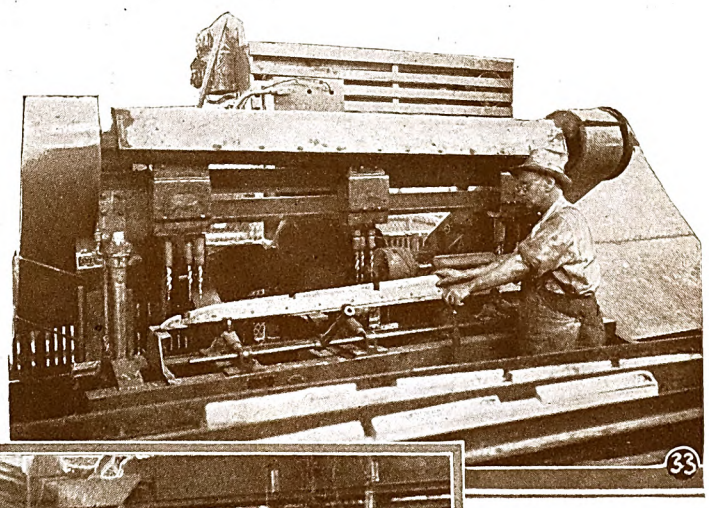


Fig. 33. Another operation on the sill frame is to bore for body bolts, as shown above.

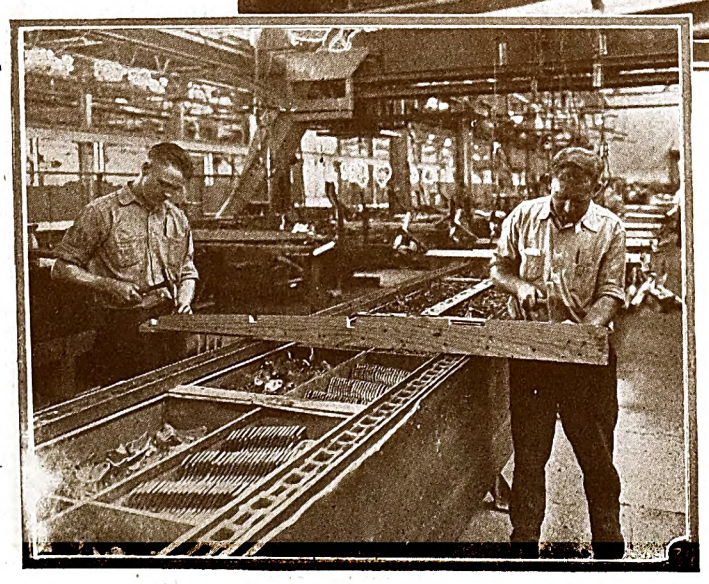


Fig. 34. At the left is the first operation in the assembly of the wooden tour car frame, namely, with driving of the body bracket bolts.

has been decided, a *waste utilization group* of presses is included in the unit or little factory. Thus this waste is worked up immediately and with the least amount of transportation into usable parts, reducing to a minimum the amount of steel scrap to be baled and remelted.

Unredeemable scrap goes to the baling room. After a bale is made and is elevated by the vertical plunger of the press it is kicked by the quick action of the horizontal ram into an inclined chute. This leads it to the underground leg of an elevating conveyor which in turn carries it up through the side wall of the building, and drops it into an open gondola car. Train loads of this scrap are pulled to the foundry where the contents are hoisted to the back stock gallery. Some three and a half car loads of this scrap is baled every day. When compared with the consumption of fifty carloads of sheet steel per day, this gives an approximate net loss, as far as the sheet metal department is concerned, of seven per cent. Inasmuch, however, as all of

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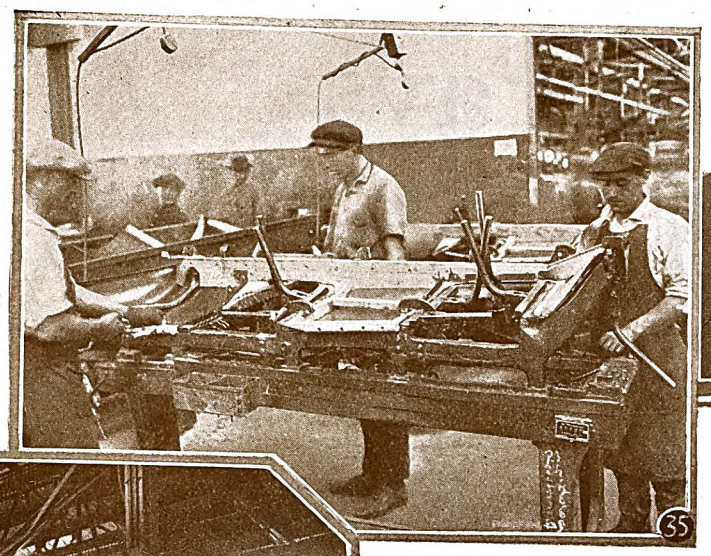


Fig. 35. At the right is shown one of the metal paneling benches where the sheet metal panel is attached to the wooden body frame.

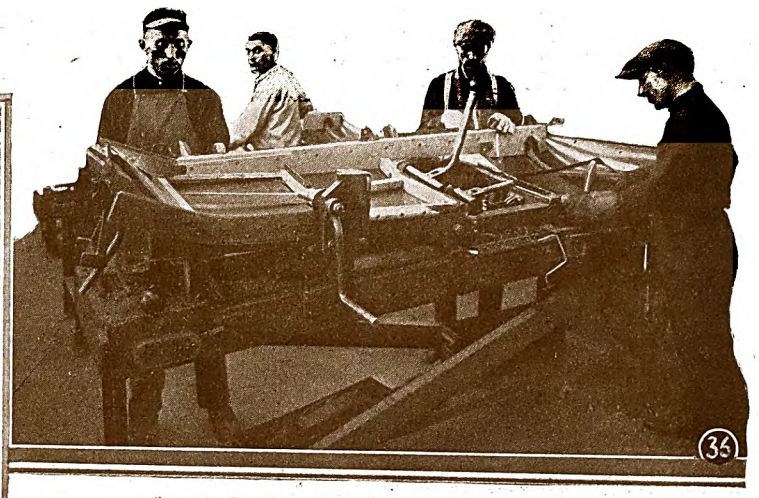


Fig. 36. Left and right hand paneling require different procedure, since there is a blind door on the driver's side.



Fig. 37. Above is a view of the door hanging line where the touring car doors are fitted.

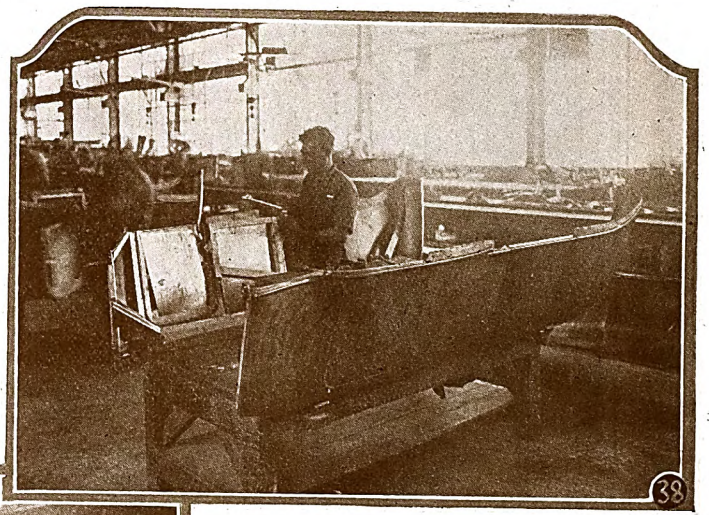


Fig. 38. A final inspection is given each complete side panel with its doors attached to see that everything is in good condition.

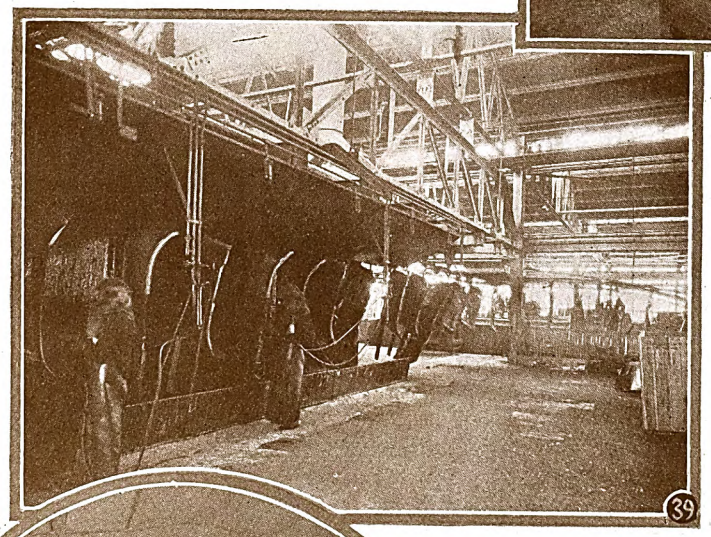


Fig. 39. At the left is a view of the paint spraying station. The side panels pass slowly, carried by the overhead travelling conveyor.

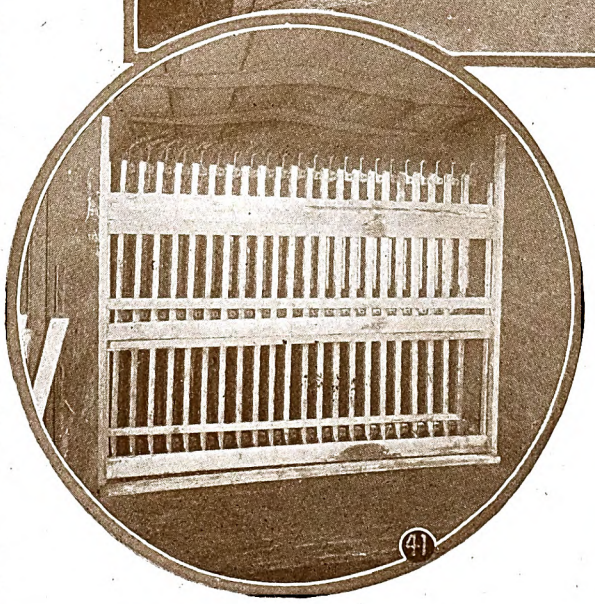
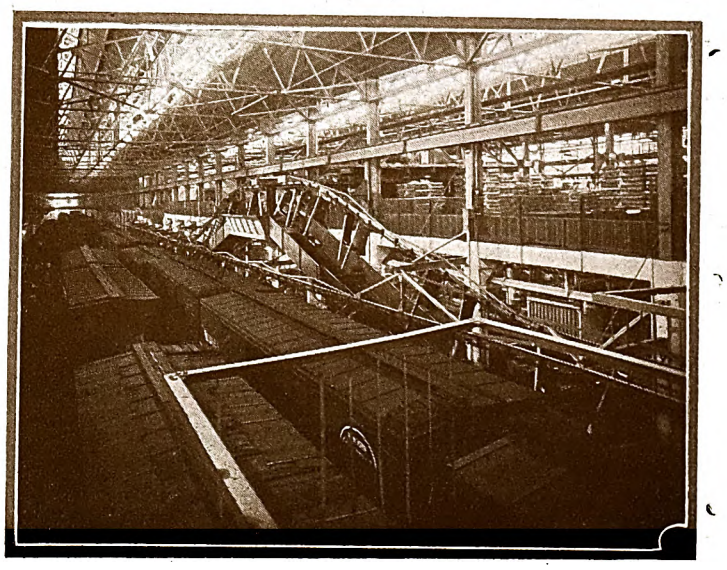


Fig. 41. Car loading has been reduced to a science as indicated above; which shows the method of stacking side assemblies in a box car.

Fig. 40. After leaving the paint sprayer the side panels descend as shown below and pass the loading stations on the freight cars.



this goes back into the cupola and thus into cast iron products, there is very little loss as far as the plant as a whole is concerned except that which is occasioned by remelting.

The raw material, *wood,* comes into this plant in various kinds, forms and sizes. A considerable portion of it is already coming from the Ford holdings at Iron Mountain and elsewhere. That received as logs is sawn into boards in a saw mill northwest of the B building, a mill having a capacity of approximately 50,000 board feet per day, power for operating which is provided through burning the bark and trash. Ultimately all of the sawing of Ford logs will be done in the forests in local mills where in fact it is intended to save considerable freight by also finishing completely many of the wood body parts.

It is truly said that the operation of the saws can make or break any woodworking plant. Boards and planks do not partake of the uniformity of dimension of other raw materials, such as steel sheets,

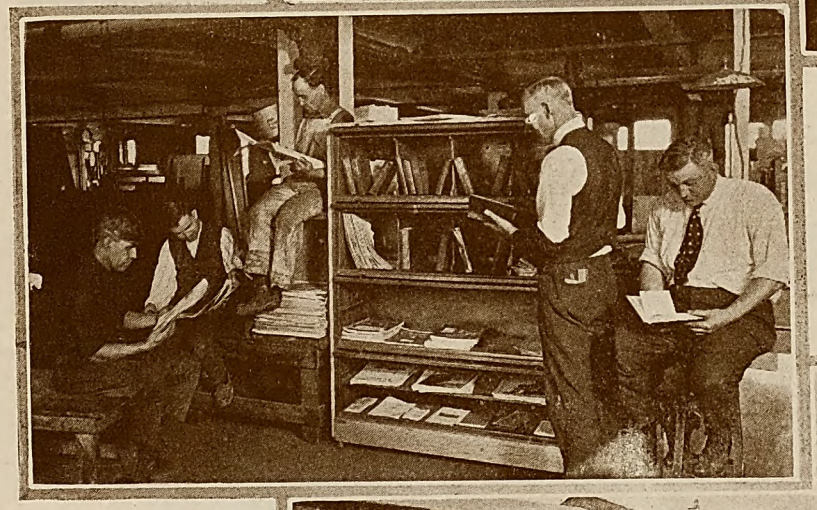
Continued on page 56)

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Industrial Americanization that Pays

By Fred H. Rindge, Jr.





Memorial Day exercises at a plant where many races and nationalities are represented. This is but one phase of the work of Americanization.



Above — The plant library is a thing all too seldom encountered; offering, as it does, a splendid means of education and stimulation toward improvement.

Above—Outdoor sport, the great leveller of race, creed and class; which here, as in Engand, has been a vital factor in the making of a good citizenry.

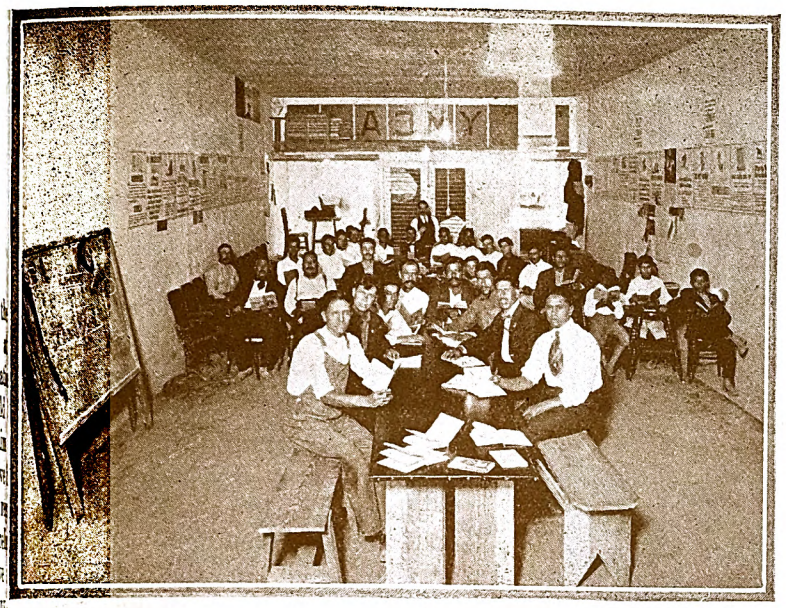


At the right—An Americanization Secretary of the Y. M. C. A. talking to a prospect for naturalization, and explaining matters in a sympathetic way.

"WHEREAS the United States is at peace with all nations and Whereas it should be the duty, desire and aim of all loyal citizens to strive for real equality among all, regardless of descent, color or religion, be it resolved that we protest against the use of any expression intended to ridicule or belittle any one because of his birth, descent, color or religion, in public speeches, the press, moving pictures or on the stage. In this connection we protest against the use of such terms of abuse as 'Chink', 'Chippey', 'Coon', 'Dago,' 'Dutchman,' 'Frog-eater,' 'Guinea,' 'Greaser,' 'Harp,' 'Heinie,' 'Kike,' 'Limey,' 'Mik,' 'Nigger,' 'Sparrow,' 'Sheeney,' 'Wop,' and similar expressions which tend to arouse dissatisfaction and ill will towards the United States, in the individuals and classes who are thereby made ridiculous."

Thus one of thousands of foreign societies in America expresses itself on a problem thoroughly familiar to industrial leaders. Every fair-minded manager and foreman will

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A typical class of Mexican peons, at El Paso, Texas, being instructed in English, and in American ideals and ways.



A shop meeting in a large plant, held under the auspices of the Y. M. C. A. This kind of work, begun during the war, should not be allowed to lapse.

agree that the sooner such terms are eliminated from business and industry the sooner we will have mutual understanding and increased efficiency.

The census of 1920 showed that there were in the U. S. 13,712,754 immigrants and 22,686,204 persons of foreign parentage. The "foreign white stock" of the nation's population showed an increase of 4,155,576 or 12.9 per cent over the volume of "foreign white stock" in 1910. Now, approximately one-third of the total population of the United States is either foreign, or entirely or partly of immigrant descent. The term "alien" is not the correct characterization of any person of foreign birth coming to this country to settle. The true natives were the Indians and all who came here were aliens. It has, however, been recognized that since America was an undeveloped country, whose native population was small and insignificant, all the new settlers from various lands united in transforming it into a habitable nation and giving it a stabilized form of government.

Our foreign people comprise thirty-five races, speak fifty-four different languages, read over eleven hundred foreign newspapers published in the United States and form the bulk of many of our most important industries. One-fourth of all the children in America are in foreign homes and over 2,000,000 white women over twenty-one are as yet unnaturalized. In 1913 we received 1,218,000 immigrants while in the fiscal year ending June 30, 1922, the number was only 309,000, largely women and children. Over 300,000 have already arrived during the present fiscal year. No one will deny that we have a great problem, which centers largely in industrial operations and communities. *The responsibility for its solution, therefore, rests to a large extent upon industry.*

Over 4,000,000 Italians live in America and read more than 300 Italian papers. About as many Poles reside here and have over one hundred newspapers with a combined circulation of at least 1,500,000 copies. There are more than 400,000 Greeks, as many Russians, 1,000,000 Czecho-Slo-

(*Continued on page 62*)

Below—Noon-hour plant band concert; a get-together feature of great value.



Below—The first requisite, of course, is to learn the language.



Below—Thirty-six nations are represented in the pageant given by these workers.



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Plugging the Power Leaks

How to Combat High Power-Costs by Stopping the Preventable Losses

BY JAMES T. BEARD, 2nd

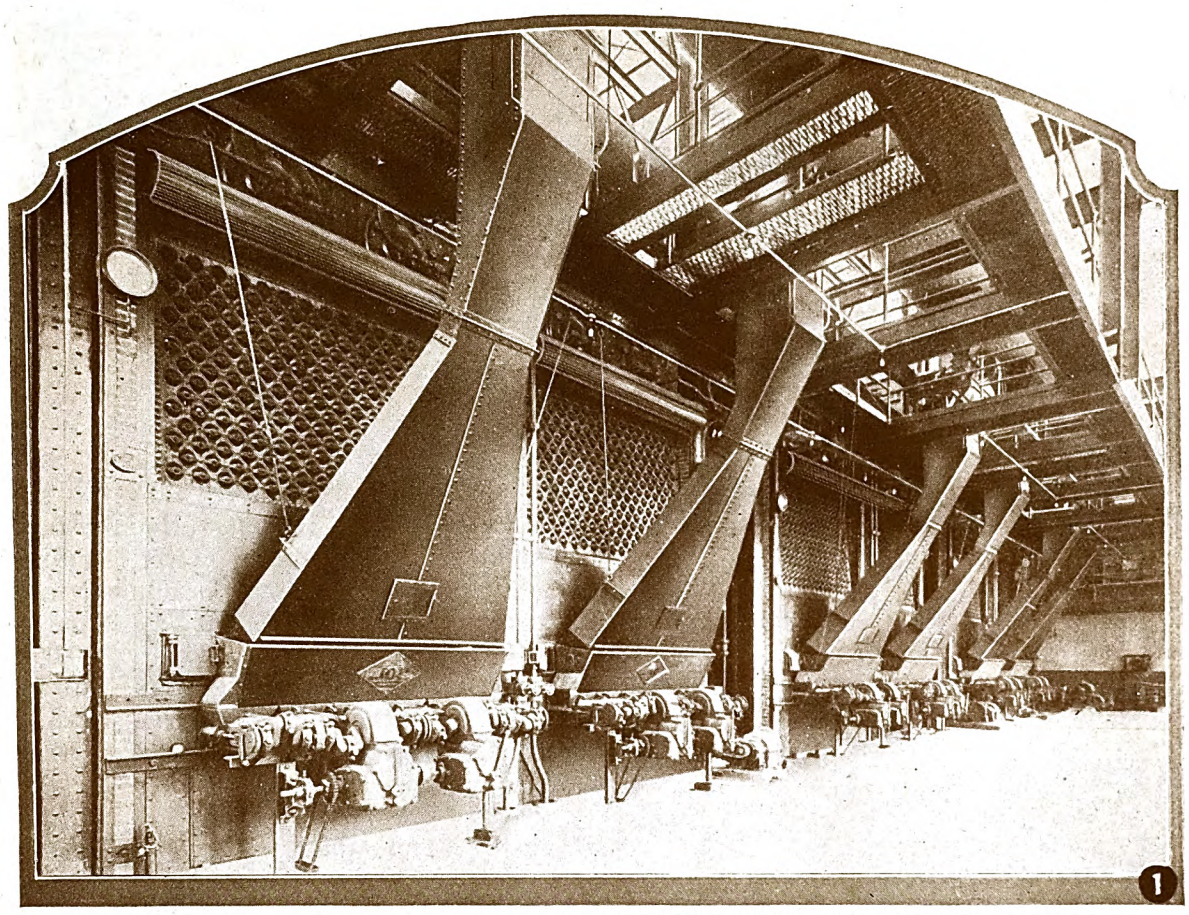


Fig. 1. Multiple-retort underfeed stokers eliminate many preventable boiler room losses because of the continuous feed, even distribution of fuel and perfect control of air supply, which makes them an essential factor in the operation of many industrial power plants.

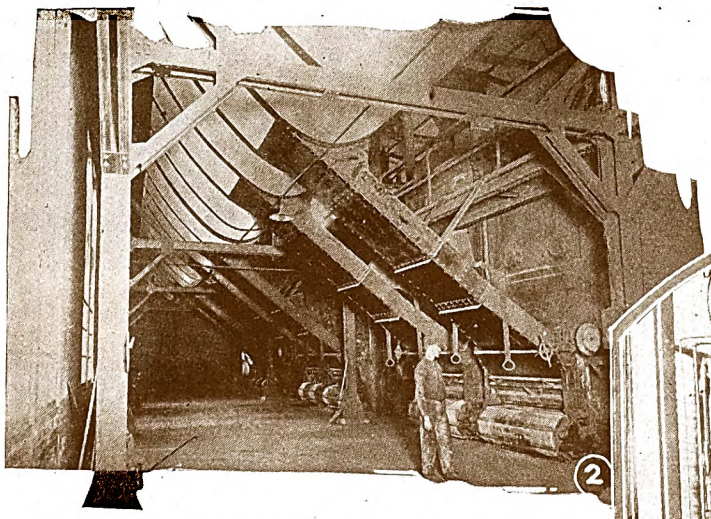


Fig. 2. What the underfeed stoker means to the plant using soft coal, the chain grate stoker means to a plant using lower grades of fuel. Many times large operating economies are made possible by the installation of these stokers and changing from a relatively high grade expensive coal to a cheaper and otherwise worthless fuel.

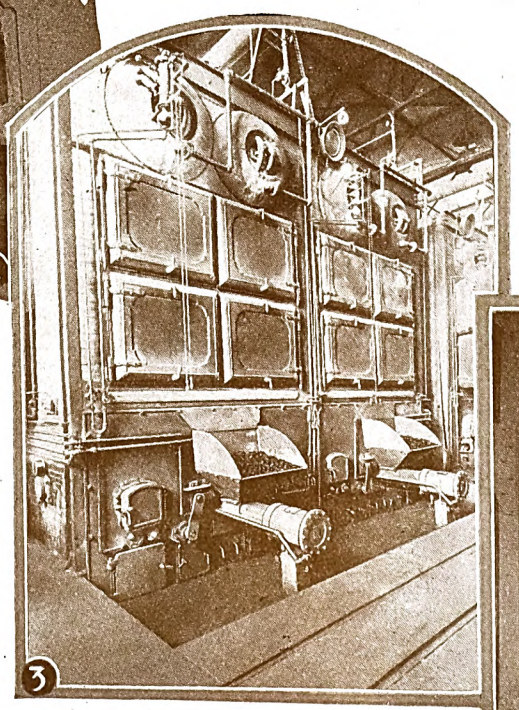


Fig. 3. What is known as a lateral-retort type of underfeed stoker has many desirable points of advantage in the operation of modern boiler plants. High capacity for a sustained period of time is possible with greater economy than hand firing.

ECONOMIES in the generation and use of steam power cannot be effected by guesswork; nor is there anything magic or mysterious about them. They are the result of the continuous and persistent application of the few common-sense principles involved, backed by an intelligent understanding of those principles and an accurate knowledge of the operating conditions existing in the plant.

Broadly speaking, the problem of steam power in industrial plants presents three distinct phases, *i. e.*, production, distribution and use. In the generation of steam in the boiler house many losses occur from the time the coal is delivered to the bunkers or the firing floor until the steam itself leaves the drums of the boilers. Some of these losses are entirely preventable; most of them partially.

In a previous article the loss of sensible heat in the stack gases and the loss of unburned coal in the ash refuse were thoroughly discussed. These losses will not be considered here, except to say that they are perhaps the most important boiler house losses, although they are readily reduced by the proper methods.

But there are other losses in the generation of steam which

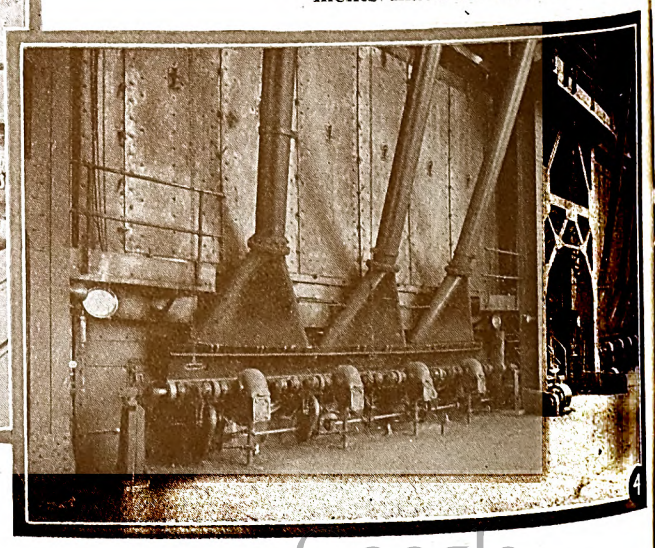


Fig. 4. Another installation of multiple-retort stokers. In recent years this type of equipment has developed into different designs as a result of the many improvements made in its operation.

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respond with equal readiness to the proper treatment. In many cases the heat radiated by the boiler and setting is excessive and represents a considerable waste of fuel. In some plants it is practically impossible to work for any length of time above the boilers, due to this radiated heat. Besides being an actual detriment, as far as working conditions are concerned, these abnormal temperatures represent a dead loss.

Although it is not possible to eliminate this loss entirely, it can be greatly reduced by proper insulation of the exposed drum surfaces and the setting, thus permitting the boiler to do its work as a boiler and not as a radiator.

The selection of the proper grade of fuel that will be best suited to the conditions of the plant is another problem for consideration. Sometimes a cheaper grade of fuel can be burned with greater economy. On the other hand, the writer has seen instances where a more expensive coal, on a tonnage basis, was actually cheaper from the standpoint of economical operation and showed tangible reduction in power costs on the books. The best fuel for the plant is usually discovered only after thorough tests over a reasonable period of time, but the savings effected are well worth the effort involved.

Proper methods of handling

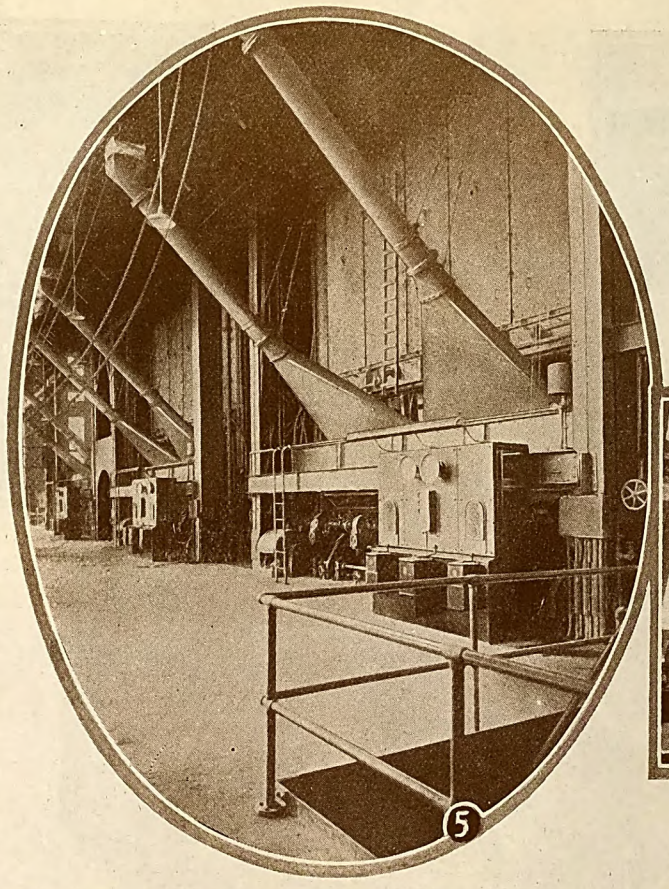


Fig. 5. With proper instruments and means for control mounted upon individual instrument boards, convenient to each stoker, uniform load distribution and high operating economy are possible because furnace and combustion conditions are instantly visible from the firing floor.

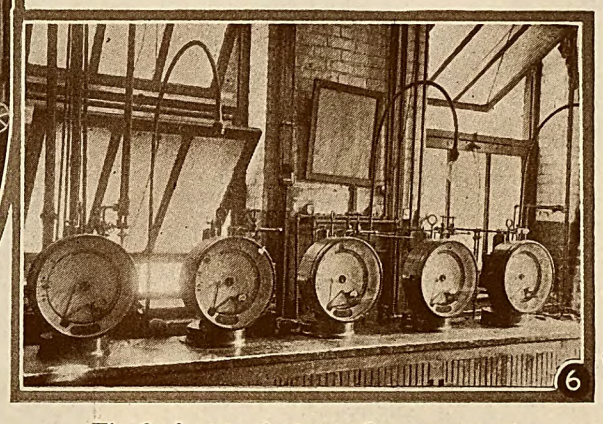


Fig. 6. A set of steam flow meters for indicating the quantity of steam generated by the boilers. This installation is located in a five-boiler plant and provides an individual check on each boiler. These instruments are often located on the boiler fronts, but the picture here shows them mounted in a clean place convenient to the chief engineer's office and readily accessible for adjustment when necessary.

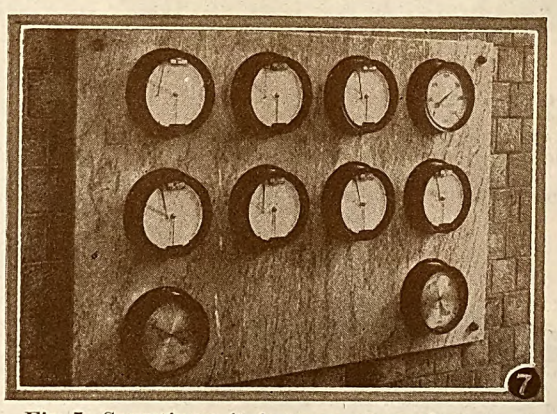


Fig. 7. Sometimes it is more convenient to locate boiler room instruments in the turbine or engine room. This is done in those plants where they will not get proper care in the boiler house. These instruments include recording pressure gages, thermometers for steam, feed water and flue gas, as well as indicating pressure gages. They are always visible to the watch engineer.

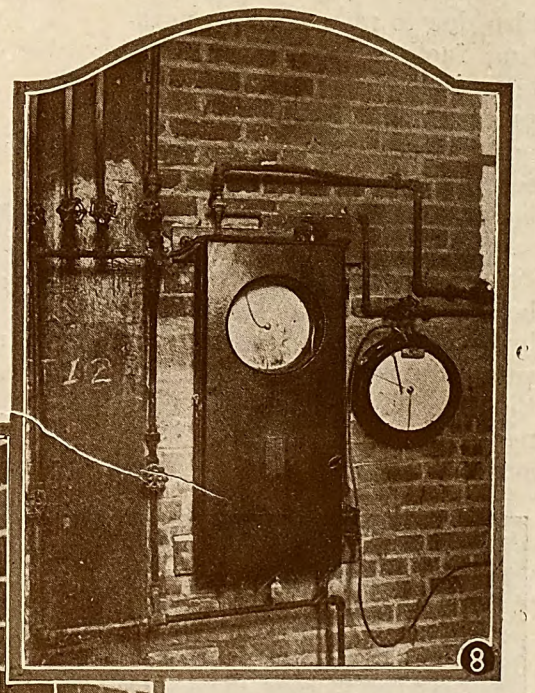


Fig. 8. It is usually practical to mount the recording flue gas thermometer near the CO_2 recorder. Thus an indication of the flue gas loss is always visible and control of this loss is at all times possible.

Fig. 11. Another type of CO_2 recorded. In this case one instrument is connected with three boilers, as well as with the stack. By suitable arrangement of valves and piping, a continuous record may be obtained of the performance of any one boiler or of the stack.

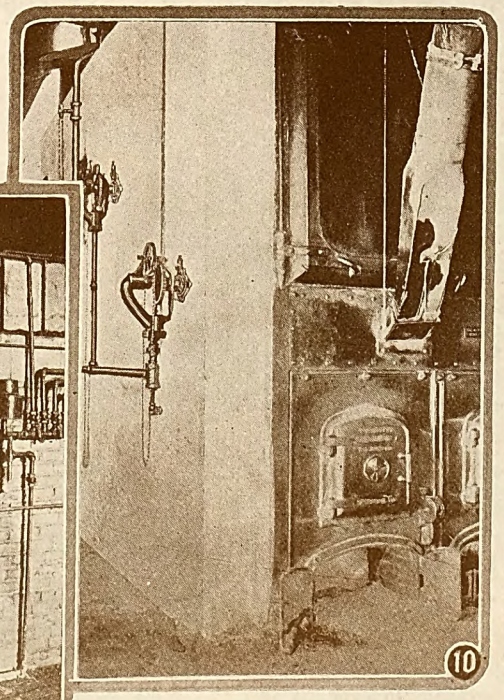


Fig. 10. A typical soot-blower installation. Rotating elements fitted with steam nozzles extend across the furnace between the banks of boiler tubes. They are repassing over a sprocket.

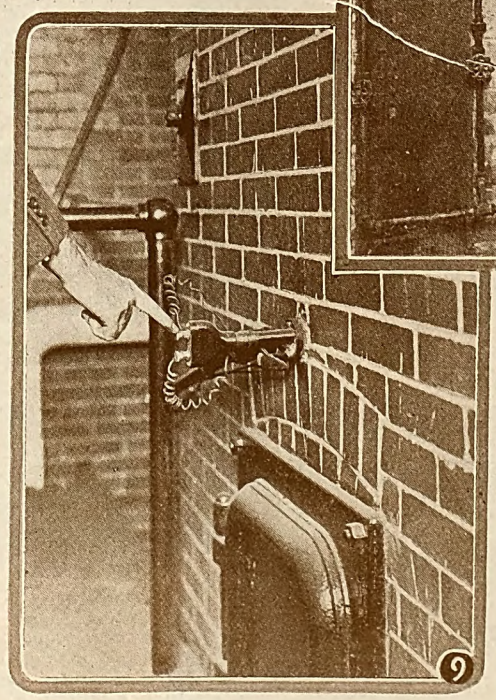


Fig. 9. This is what the terminal end of the thermo-couple looks like. The point of the couple extends into the boiler setting and is sensitive to variations in temperature, transmitting these changes to the electrical recording or indicating pyrometer.

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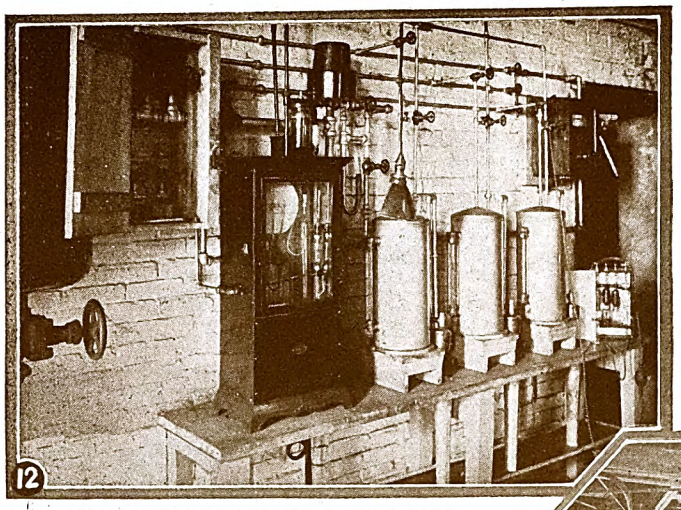


Fig. 12. Frequently it is desirable to use sampling cans in conjunction with a CO_2 recorder. These cans operate to automatically sample the flue gases at regular intervals during the shift. The per cent. of CO_2 in the can at the end of the shift is considered an average reading for that particular boiler during that period. They cost less than a recorder but do not give continuous service. Their value, nevertheless, should not be minimized.

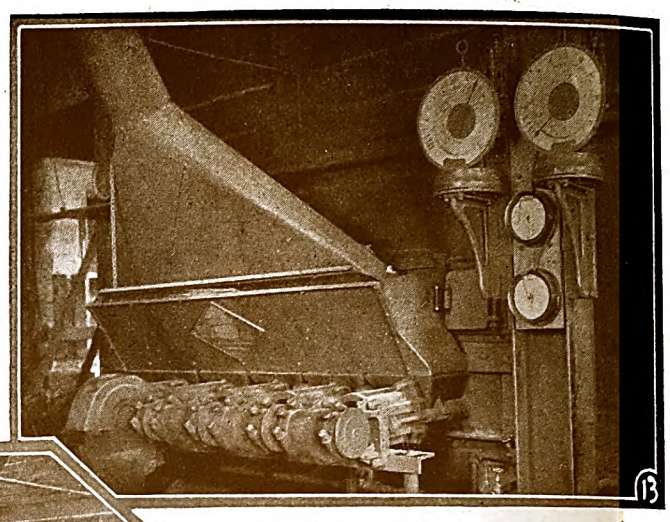


Fig. 13. A stoker installation in which steam flow meters and flue gas thermometers are mounted directly on the boiler front gives an instantaneous check on one of the largest preventable losses in any plant.

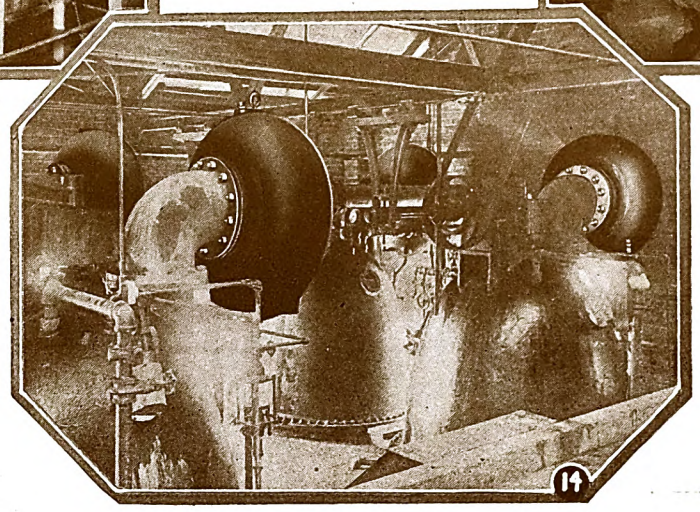


Fig. 14. The use of separators on evaporators or similar equipment insures clean steam and prevents fouling of the product or of the interior surfaces. In many cases such equipment is not only economical but absolutely essential.

coal and ashes have been discussed in a previous article and it is sufficient to say that the installation of a system best adapted to the requirements of the plant will inevitably result in reduced labor costs.

Excessive labor costs are also due to many other operating factors. Boiler cleaning is an item that often shows up pretty large on the cost records. Permanent soot blower equipment, installed in the boiler setting, is far more economical than the steam hand lance. It does the same work better, quicker and cheaper, by reducing the steam consumption required in blowing the tubes, by reducing the time necessary to do the job and by cutting the labor costs for this class of work.

When impurities in the boiler feed water make frequent internal cleaning necessary, labor costs and fuel losses increase proportionately, as pointed out in an earlier article on feed water treatment. By proper treatment of the boiler feed it can be rendered harmless, the period of time between cleanings can be greatly lengthened and the cost of turbining can be reduced to a reasonably low figure.

The cost of repairs, renewals and maintenance is always an important item in the total power cost. In a large number of cases power could be produced at less expense and the

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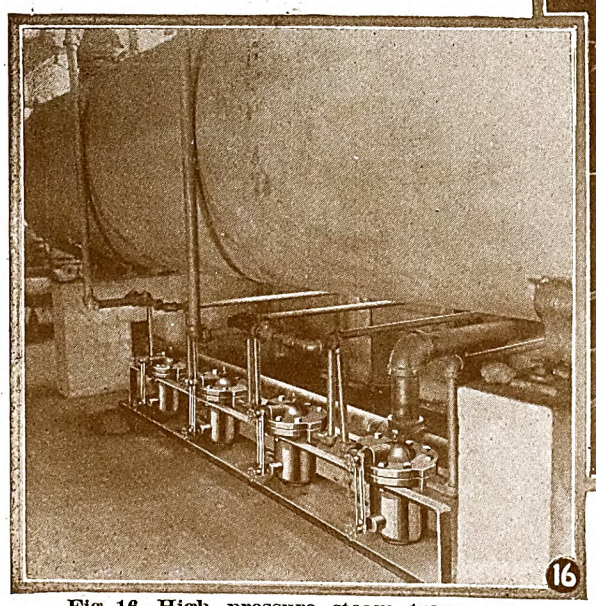


Fig. 16. High pressure steam traps are often essential on certain steam headers. Where they are used, however, it is important that they be given the attention to which they are entitled. Too often they are neglected and fail to operate or discharge live steam to the waste pipe.

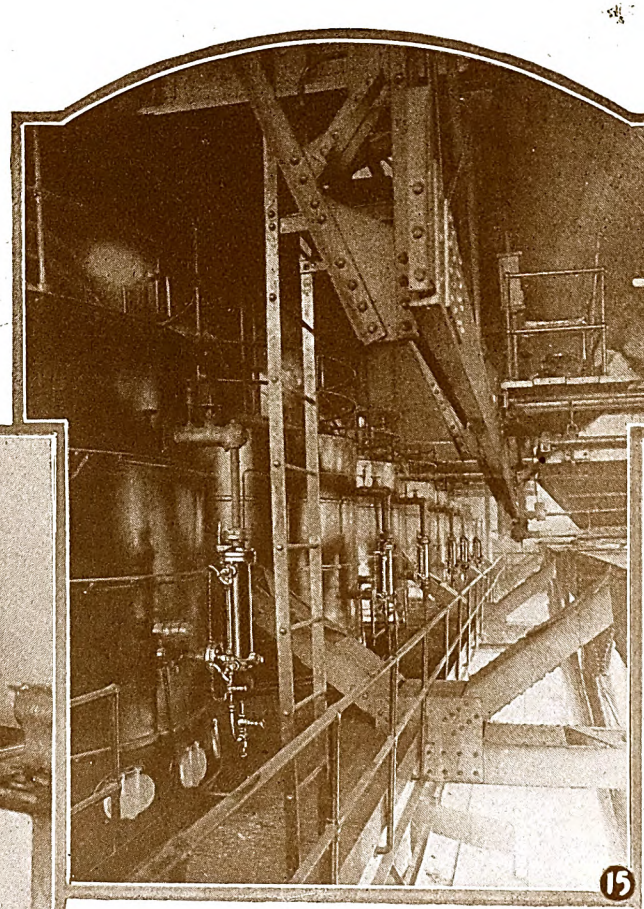


Fig. 15. Safety alarm water columns give reliable and positive knowledge of the water level in the boilers and often call attention to failure of feed water supply or other conditions which might lead to damaging results or expensive repairs.

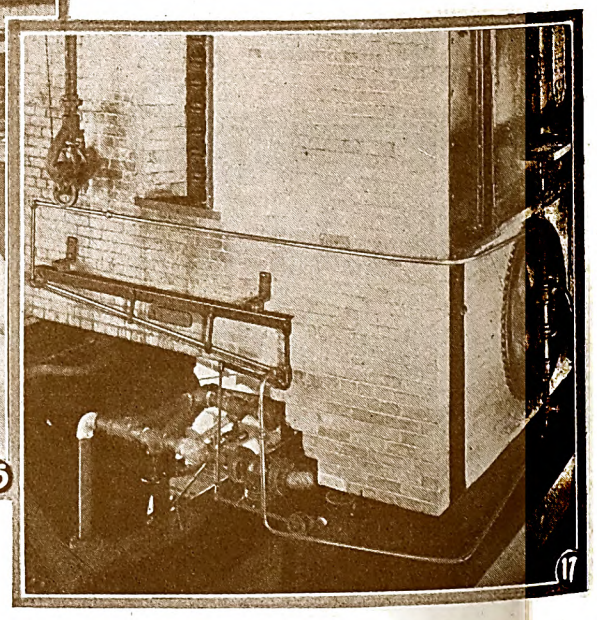


Fig. 17. Automatic feed water regulators control the supply of water to each boiler and, if properly designed, admit this water at the most advantageous time, interfering with the steam capacity as little as possible.

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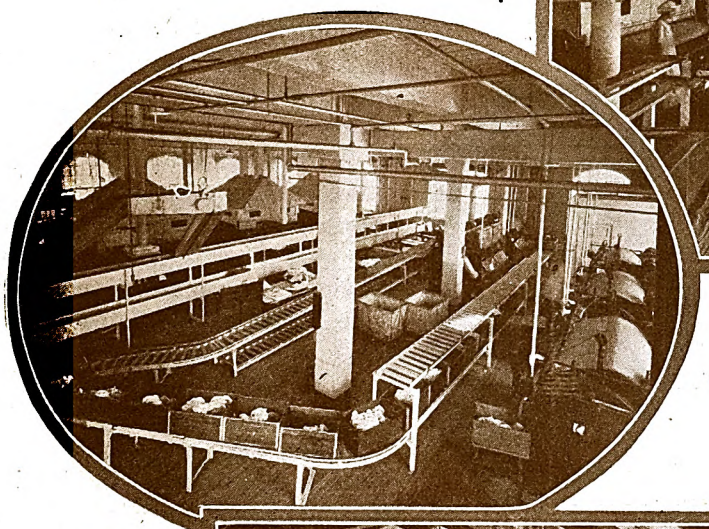
Speeding the Family Wash

The Moving-Production Idea in a Modern Laundry

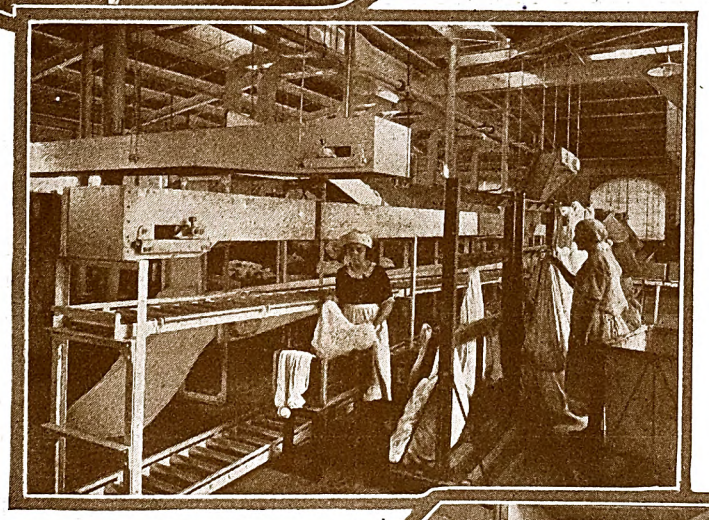
By Ernest H. Rowe



Below—Looking down on the wearing apparel department. Coming to the tumblers at the right by conveyor, articles go from there on the upper conveyor to wrapping tables—thence on belt conveyors to shipping rooms.



Above—The modern laundry certainly bears no resemblance to that of a generation ago!



At the left—The upper gravity conveyor goes to tumblers, the empty nets return on the belt conveyor above, and boxes to be filled come to the operator on the lower gravity run.



Below—Wrapping tables; with work coming in on the lower gravity conveyor, empty boxes returning on the upper. Wrapped parcels go to shipping department on the lower belt conveyor, while identification tags return on the one above.



A view of the wrapping department for flat work.



Below—Here the identification tags and nets return from the wrapping tables, to be started on another of their endless trips.

TAKING the drudgery out of housework has so many aspects that a whole book could be written about it with chapters ranging all the way from high-brow sociology to dustless dustrags. A hundred years ago the wage earners and their occupations began to be taken out of the home and transferred to the newly developed factory with its mechanical power and machines. Now housework itself is taking much the same course, accelerated by the disappearance of servant hand-power just when woman's broadened range of activity makes her want, and makes it possible for her, to be more than a housewife.

Not the least important chapter in the aforesaid book would have for its theme the weekly wash. In fact it's so big (the subject—and the wash, too, sometimes) that it could supply three or four chapters. This is one of them, or rather part of one. There are three household drudgeries that nobody loves: dish-washing, floor-scrubbing and "the wash"; and the greatest of these, to nine women out of ten, is that early-rising, all-day, back-breaking, knuckle-skinning, steamy, sloppy, hot-in-summer-and-cold-in-winter job of washing the family's

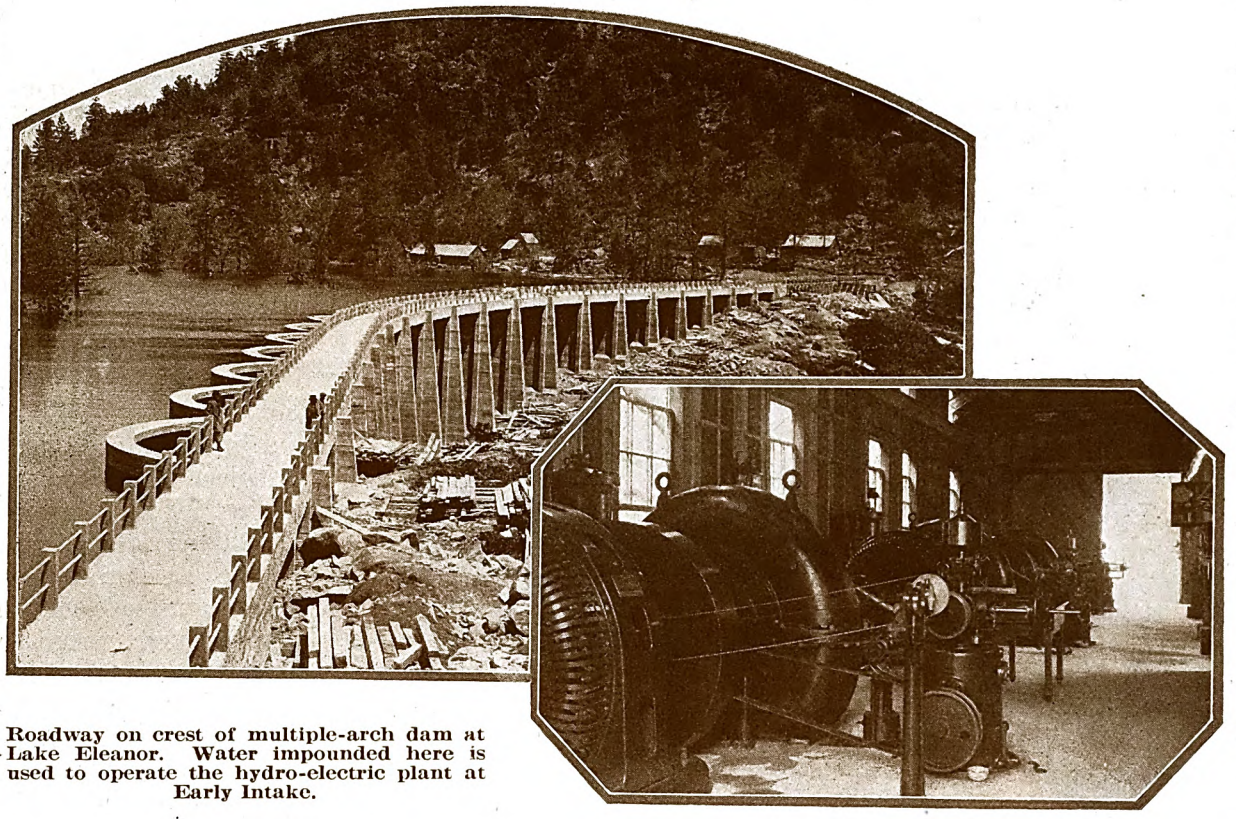
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Combining a Water-Supply

The Hetch-Hetchy Project

BY JAMES

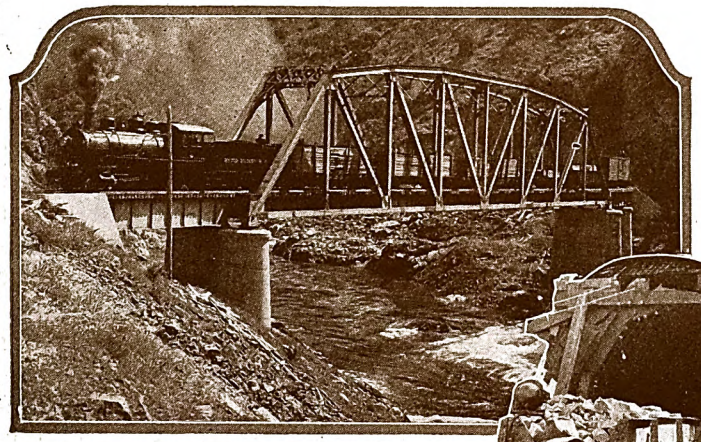


Roadway on crest of multiple-arch dam at Lake Eleanor. Water impounded here is used to operate the hydro-electric plant at Early Intake.

Power house at Early Intake.

WATER is dammed for several purposes. One of the most important, perhaps, has for its object the control of water in flood areas. Another purpose is to develop at one or a few points the hydraulic head distributed over a region of rapids. Still another purpose concerns the development of elevated storage reservoirs designed to furnish the water for a water supply system. The present article deals with an enterprise which involves a very notable instance of dam construction presumably for the primary purpose of serving a large city with water. But it often happens that more than one purpose may be covered. That is more or less the case with the Hetch-Hetchy project just referred to, which will furnish San Francisco with Sierra water and also with electric energy.

It is in fact becoming very customary to utilize the fall of water, dammed with other objects in view, to develop electric current for power purposes. The great Gatun Dam of the Panama Canal serves primarily the purpose of creating Gatun Lake through which a very large section of the canal has its course and by whose considerable area the flood waters of the old torrential Chagres River are controlled. Two purposes are here served. In fact, a third is covered. All lock canals require elevated water to supply the locks. At Panama, Gatun Lake takes care of the require-



Hetch-Hetchy R. R. crossing of Tuolumne River, whose water is a chief dependence of the Hetch-Hetchy Project.



Portal of Priest Tunnel. A muck train, hauled by electric storage battery locomotive.



The Hetch-Hetchy dam site, before the beginning of construction work.

Soon after excavation work began for the Hetch-Hetchy Dam.



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and Power Development
at San Francisco

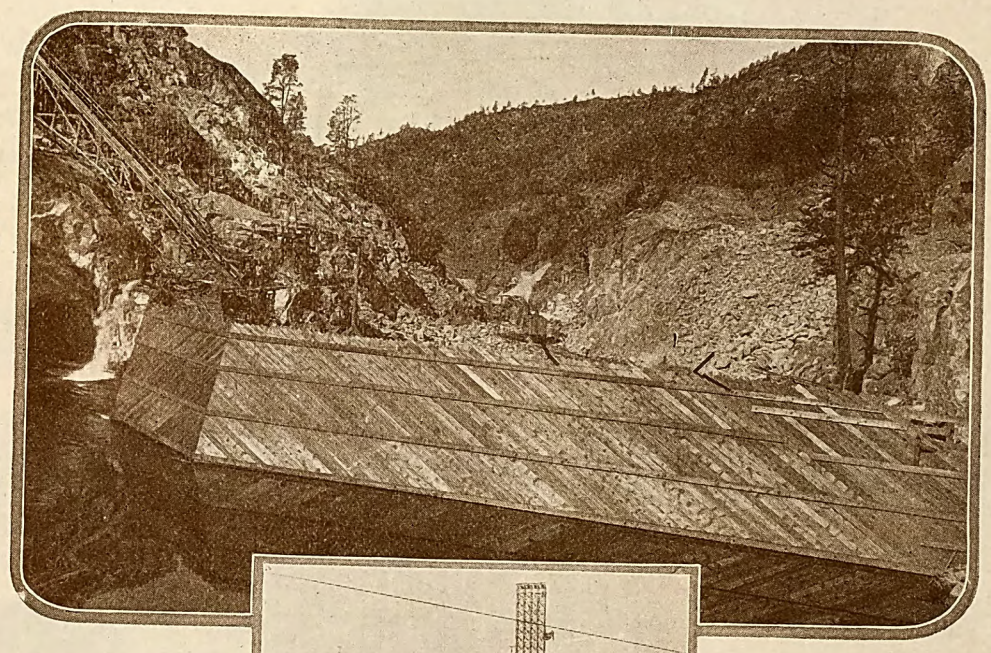
STEELMAN

ments of great Gatun Locks near the Atlantic terminus. Notwithstanding the fact that the big dam makes possible the performance of all these functions, the Government has in addition provided for a hydro-electric power plant for the purpose of utilizing the fall of waste water from Gatun Lake.

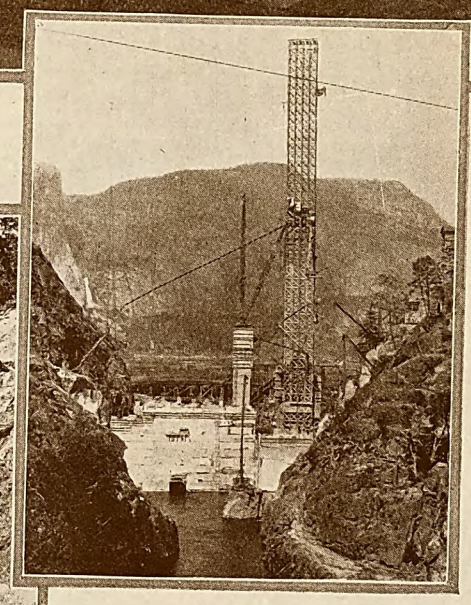
The San Francisco project, known as the Hetch-Hetchy Water Supply, is to bring to the city and smaller centers of population in the neighborhood a supply of 400,000,000 gallons per day. Some of this water will come from the neighborhood of the Yosemite Valley and some from regions not so distant. However, the consideration that San Francisco will need a great deal more power than is now being delivered by local plants has brought about some modification of the construction plans. It was intended that hydro-electric plants should be constructed close upon the completion of the first aqueduct unit carrying water from the Tuolumne River to the city. It now transpires that the old water supply system is to be developed to the point of taking care of the water needed for the city for the next decade. This releases the Hetch-Hetchy project from any great pressure for haste, in so far as delivery of water to San Francisco is concerned.

On the other hand, the city is in such urgent need of power that the hydro-electric feature of the great enterprise is to be

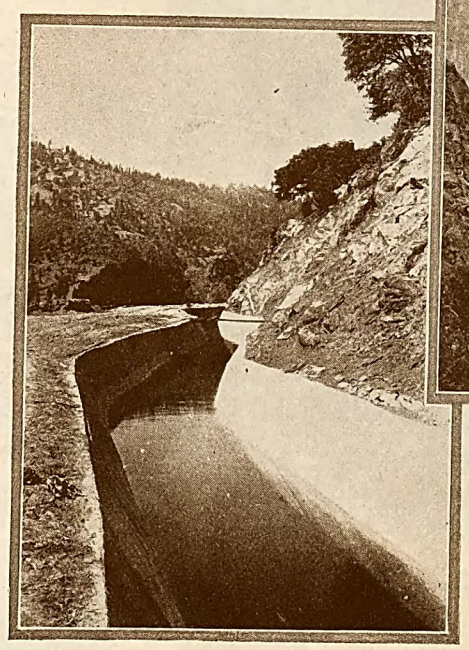
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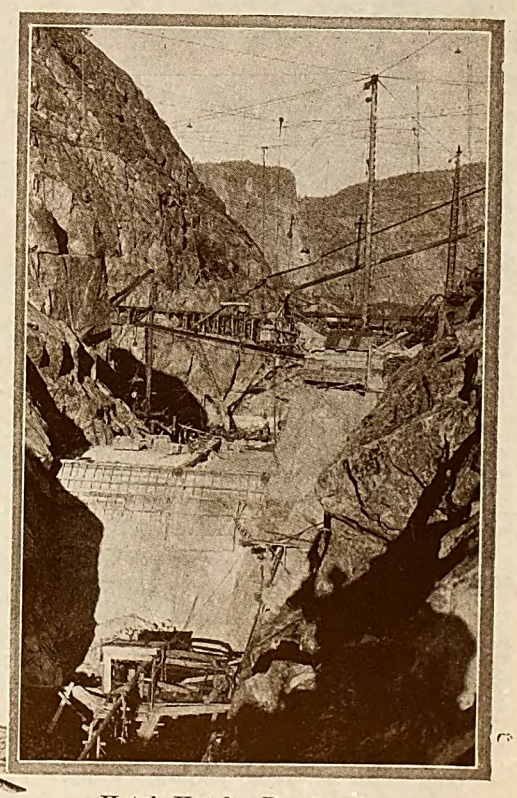
Diversion dam, for guiding the water of Tuolumne River into the tunnel on the left, and thus facilitating construction of the Hetch-Hetchy Dam.



A 350-foot elevator tower for hoisting concrete to the distributing chutes at the great dam.

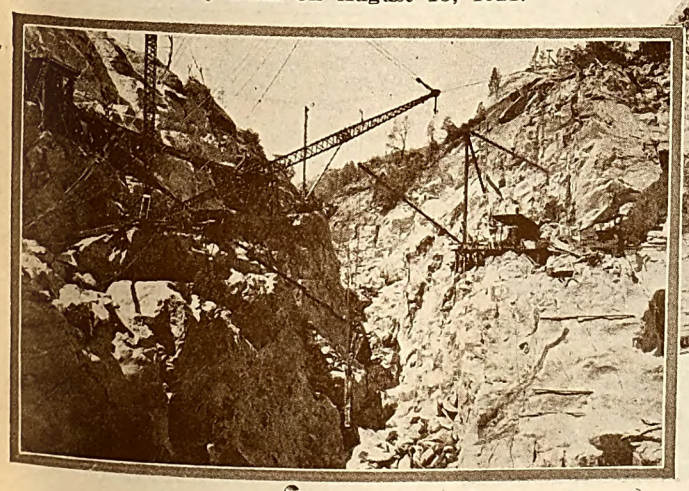


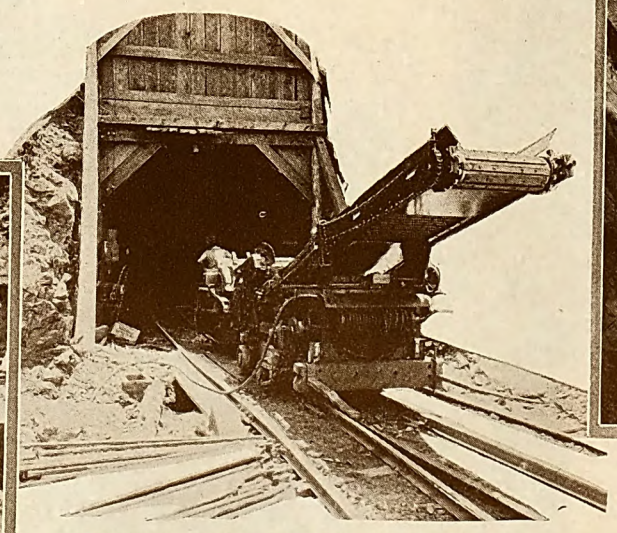
The Lower Cherry hydro-electric power development is served by this concrete-lined canal, whose daily capacity is 130,000,000 gallons.



Hetch-Hetchy Dam as it appeared on November 20, 1921.

General view of site of the Hetch-Hetchy Dam on August 15, 1921.





Mucking machine at the portal of one of the tunnels.

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Developing the Full Capa

Tractor-Trailer Trains

BY MATTHEW

AN editorial in the *New York Tribune* for July 23rd, 1923, calls attention to the migration of negro labor from the South, and the introduction of a bill in the Georgia legislature which will make it a felony to solicit labor in Georgia for other states, and the consideration of a bill in the Alabama legislature to tax labor agents $5,000 for every county in which they operate. Other states in the South are seeking almost in desperation, a means to check the outflow of colored workers.

The following is quoted from this editorial:

> "The migration which has been in progress for several years shows no signs of abatement. Last year more than 3% of Alabama and South Carolina negro farm hands, moved North. Georgia lost 13%. This year the exodus is even more alarming. The cotton planters have been exceedingly hard hit."

The South has long depended upon negro labor to carry the burden of moving ma-

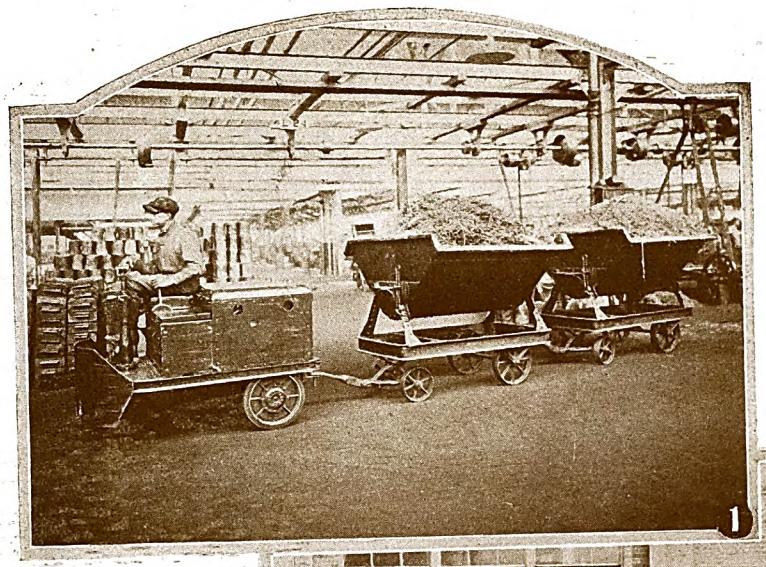


Fig. 1. Side dump hopper trailers bringing metal scrap from machine shop.



Fig. 2. Same load as figure 1, on hard roadway, going to dump.



Fig. 3. Tractor driver driving load to empty space in dumping pile.

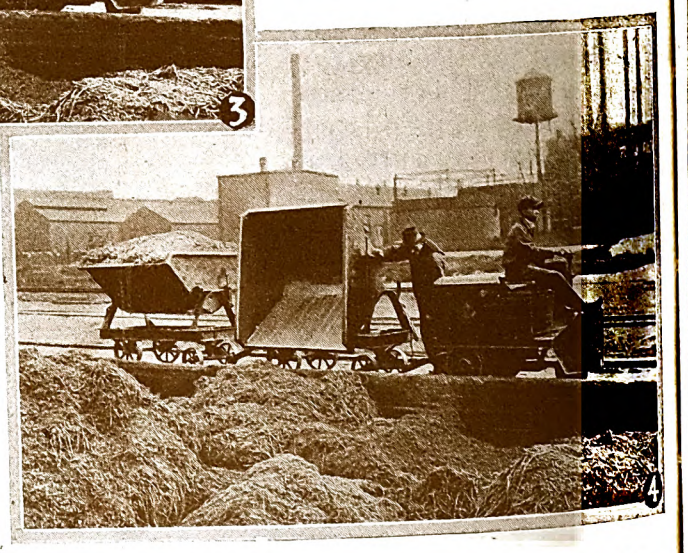


Fig. 4. Transporting and unloading of trailers is the keynote of economical handling.



Fig. 5. An excellent example of the trackability of four-wheel steer trailers. Wherever the tractor can get through the trailer will follow, no matter how long the line may be, when this type of trailer is used.

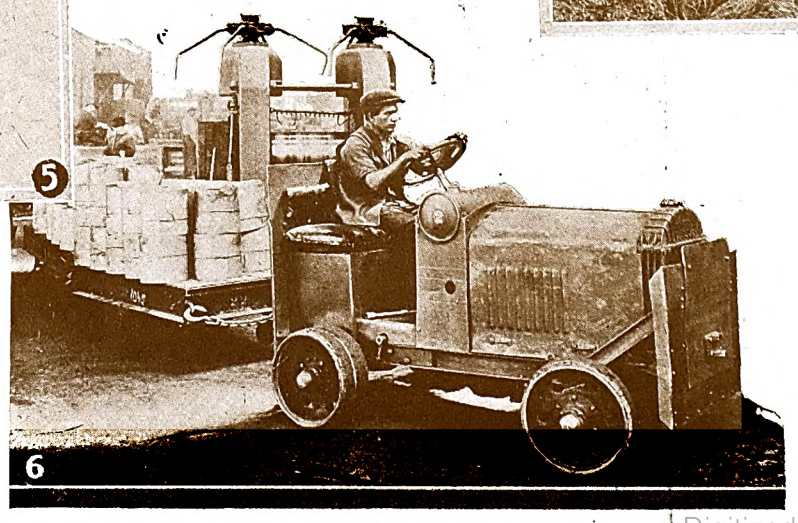


Fig. 6. In heavy machine and foundry work where there is plenty of space, the gasoline tractor is recommended for motive power.

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cities of the Factory Tractor

in Intra-Plant Haulage

W. POTTS

terials, and most of this work has been done by hand, but at the present time, a large number of inquiries are being made to material handling equipment manufacturers by Southern industrialists, to see how this equipment can be applied to their labor needs. Figures 1, 2, 3 and 4, also figures 9, 10 and 17, show why the negro comes North, and engages in industrial work. In each illustration mentioned, the tractor driver is a negro, and while they are not the most dependable type of help, they quickly acquire the knack of running power equipment, particularly if a little attention is paid in educating them. They naturally take the line of least resistance, as shown in the first four illustrations.

Figure 1 shows a tractor starting with a load of steel shavings which have been collected in the shop, and placed in hopper body trailers. Figure 2 shows the same train passing along a driveway outside the shop; while figure 3 shows a train drawn up along side of the dumping pit, and

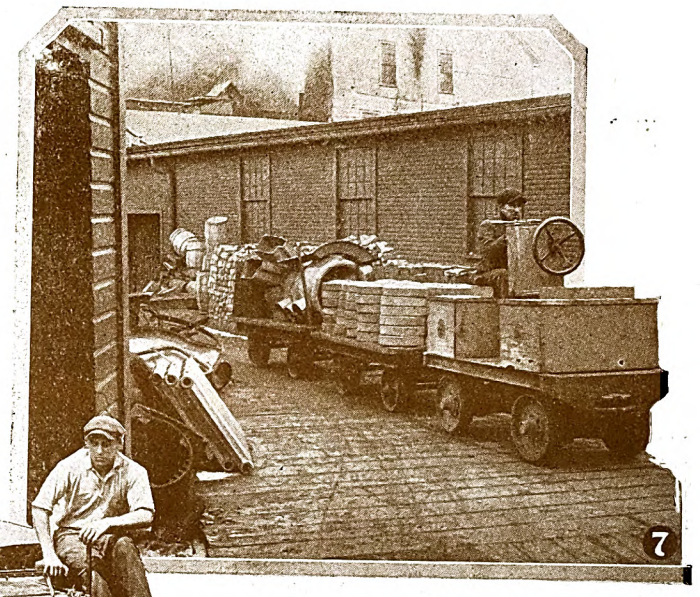


Fig. 8. Long trains of trailers, heavily loaded, and operating over asphalt or concrete roadways, save enormous sums in intra-plant handling.



Fig. 10. It is not recommended that caster trailers be hauled any great distance over rough cobblestone pavement, as shown in this illustration.



Fig. 7. For yard work, wooden roadways can be used, if the loads are not too heavy, but where heavy loads are hauled, the maintenance cost of wood roadways will be high.



Fig. 9. On outside work, large wheel trailers and gasoline tractors make the best combination.

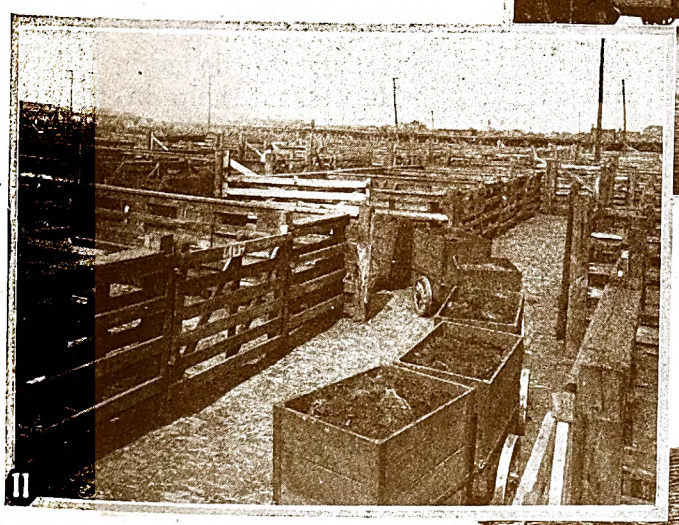


Fig. 11. Handling refuse in the narrow aisles of stock yards has always been a problem. Electric trucks and trains of trailers have solved this problem with large money savings. Note "S" turn of trailer train.

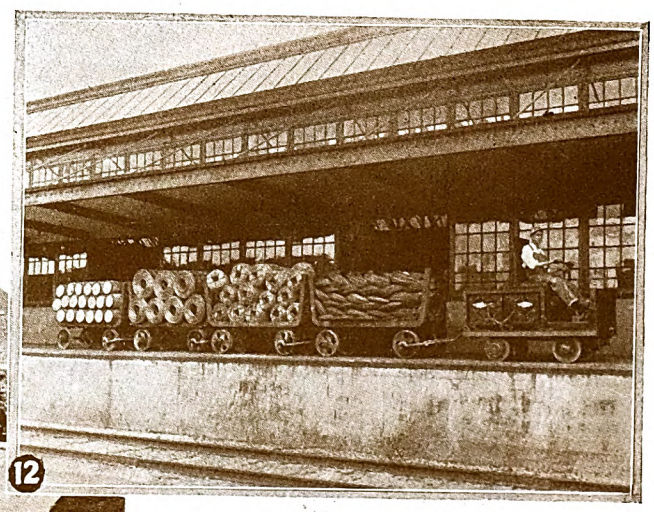


Fig. 12. The secret of economical operation is heavy loads. This shows a tractor handling approximately 6 tons of material on four trailers.

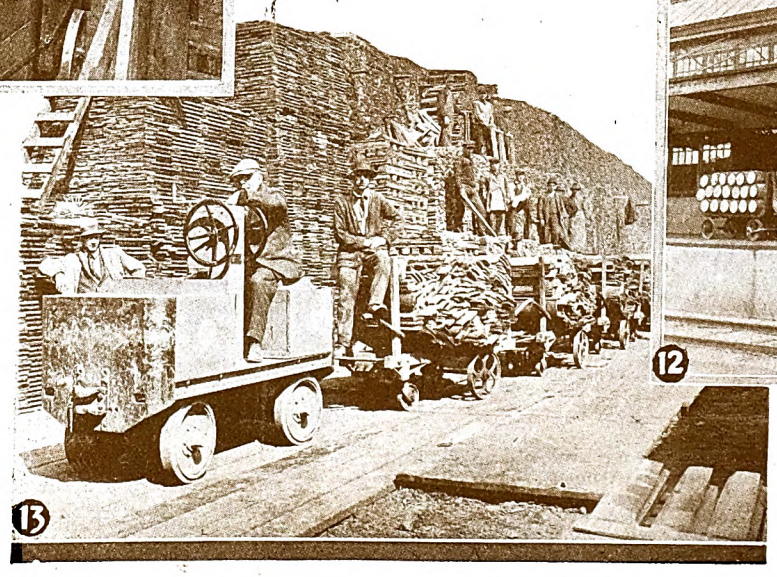


Fig. 13. When loads are light, long trains of trailers can be hauled. This is a system of handling barrel staves in the cooperage plant of a large oil company.

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Fig. 15. While concrete roadways wear out somewhat quicker than asphalt roadways, under tractor trailer traffic, the reduced frictional losses offset the additional maintenance expense.





Fig. 14. Some municipalities have investigated the use of material handling equipment. The tractor shown is hauling dump body trailers used for coaling the Staten Island ferries which ply between Port Richmond and New York City.

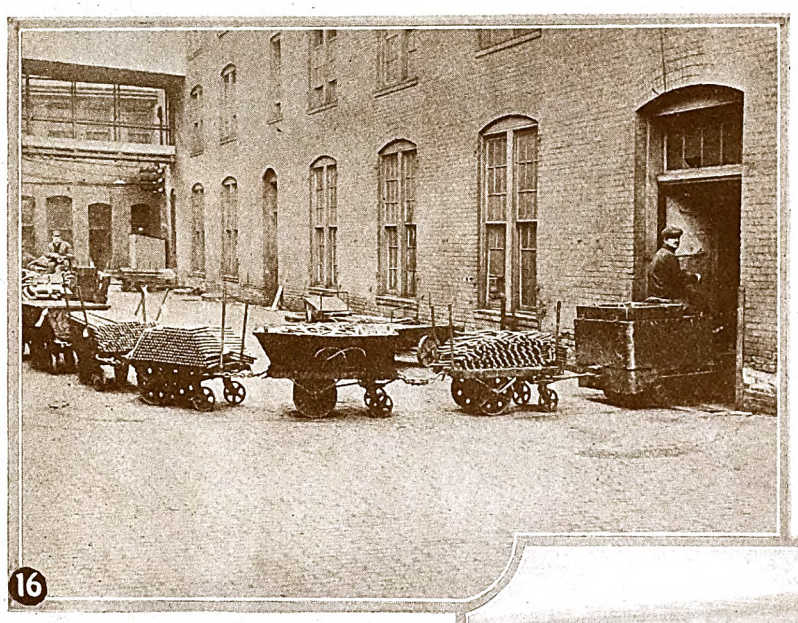


Fig. 16. Tractor making delivery of six trailers loaded with approximately 15,000 pounds of material. Before delivery is completed, the tractor passes through four swinging doors, the only labor required being the tractor driver.

figure 4 shows how the load is dumped by a man, who also trims the load in the storage bin. The driving of a tractor being so simple the negro is particularly delighted and satisfied while doing this easy work, but if the work were performed by the average intelligent white man, it would be done better, as certain negro characteristics have not been eliminated, and will not be eliminated unless extensive education is done for the race.

There is no need for the Northern industrialists to strip the Southern states of negro labor, but the Southern industrialists can do much to keep the present help in its own fields by installing material handling equipment. The South is accustomed to the Negroes, and knows the proper way to



Fig. 17. Special trailers for handling cumbersome materials are accessories that help to keep the tractors busy, and reduce handling expenses. These trailers are handling locomotive wheel tires.

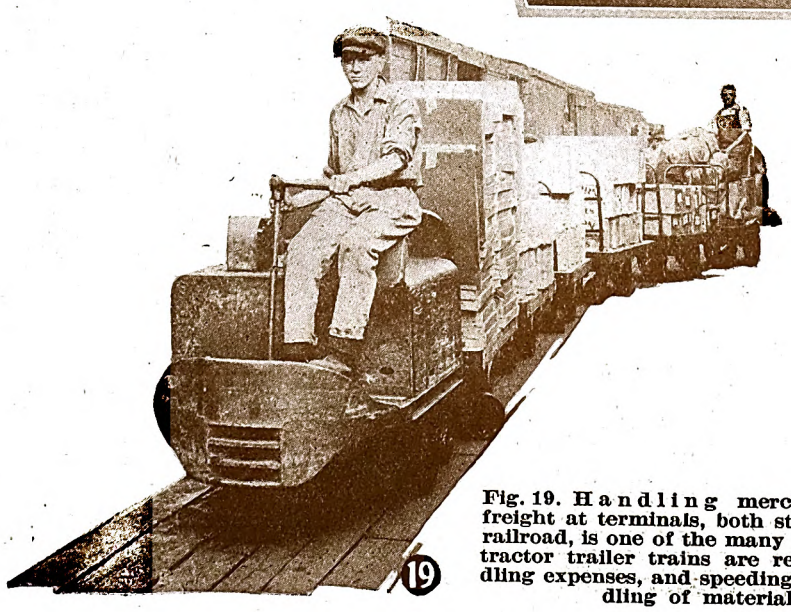


Fig. 19. Handling merchandise and freight at terminals, both steamship and railroad, is one of the many places where tractor trailer trains are reducing handling expenses, and speeding up the handling of materials.



Fig. 18. If tracks are already installed, the electric tractor can be used for hauling of cars. This installation is at a receiving station of the Chicago Tunnel Company, which uses a number of these tractors.

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Fig. 20. This is a part of the material handling installation that saved $200 per day in handling costs at the Minneapolis Steel & Machinery Co.

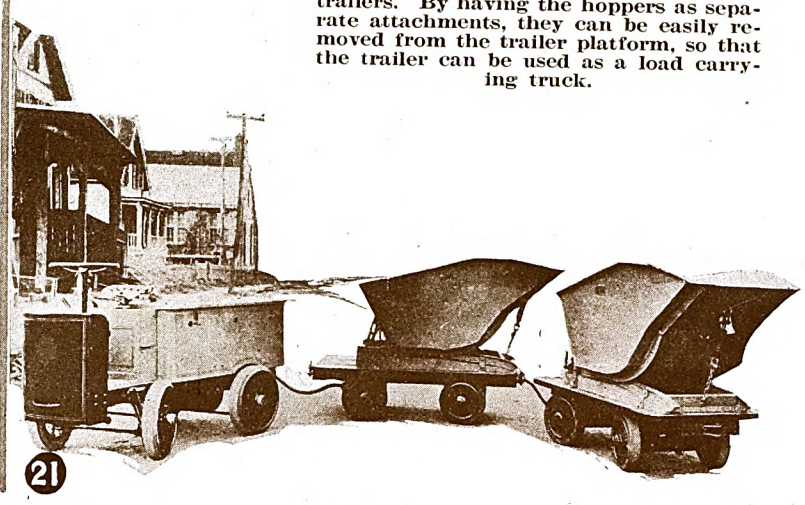


Fig. 21. Frequently it is necessary to use end dump instead of side dump hopper trailers. By having the hoppers as separate attachments, they can be easily removed from the trailer platform, so that the trailer can be used as a load carrying truck.

handle them, while the North will have a hard time assimilating and becoming adjusted to large numbers, as we do not have the restrictions in the North that are now provided in the South regarding the negro question.

This is shown by the recent development in the last year, where the negroes have taken over a considerable portion of the medium class white residential section, along St. Nicholas Avenue, in New York City. Undoubtedly this is caused by the influx of negroes from the Southern States, as mentioned previously.

Too much has been said regarding the necessity of obtaining cheap labor for plants in the North, and it does not matter whether this labor is imported from Southern

(*Continued on page 44*)

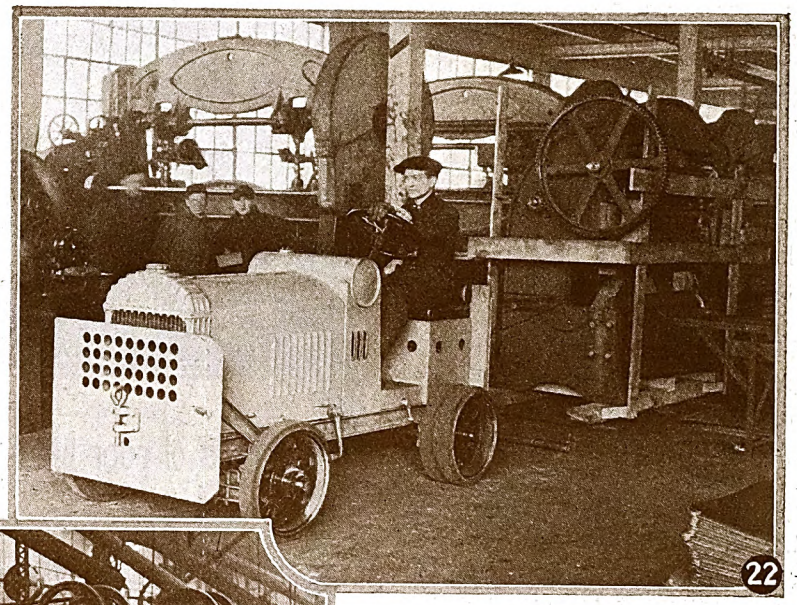


Fig. 22. Moving heavy machinery quickly and cheaply is another place where the tractor can be used to advantage.



Fig. 23. This tractor is making a difficult turn in congested portion of the punch and shear department, with three trailers carrying approximately 6,300 for delivery to forge shop. The wheelbarrow inside the white aisle lines, is in transit but waiting for tractor to pass, the tractor having the right of way.



Fig. 24. Handling assorted merchandise is difficult with hand trucks while flat platform trailers hooked in a train can handle this class of material quickly and cheaply.

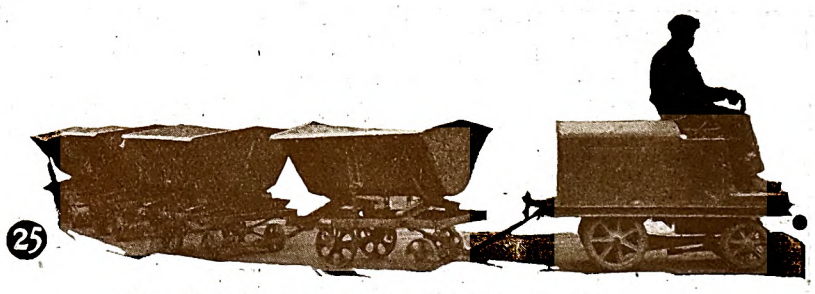


Fig. 25. Fifth-wheel-steer trailers operate best in short trains, not exceeding five trailers in length.

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Good Housekeeping in the Modern Plant

By Sanford DeHart

Director of Hospital, and Employment Manager, The R. K. LeBlond Machine Tool Company.

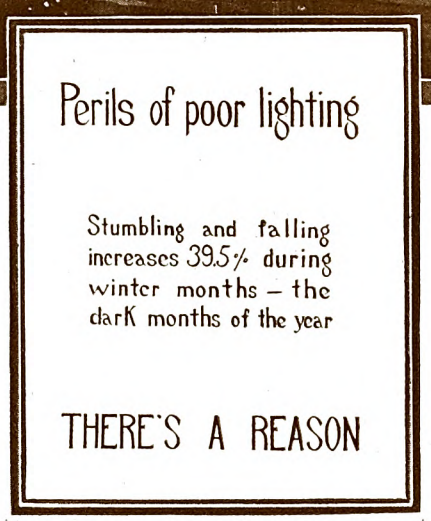
THE problem of increasing output in the face of the present labor shortage is being solved by many industrial managers in various ways. New methods are being devised to prevent accidents and sickness among the workers. An ingenious industrial manager has reduced the accidents more than 60 per cent. in a plant that was considered hazardous and noted for its high frequency accident rate. This manager is of the opinion that there is no better plan to save labor than to reduce accidents and sickness. Cutting down a large part of shop accidents is equivalent to adding hundreds of new men.

A recent survey on the causes of waste in industry, compiled at the direction of Herbert Hoover, showed that the largest waste in industry was due to sickness and accidents.

Industrial managers have found that reducing accidents and sickness in the shop is largely a matter of good shop housekeeping. We are no longer amazed when we read that a shop employing several thousand persons spends $100,000 a year to keep the shop clean, and this same shop goes the entire year without a single serious accident to one of its thirty thousand workers.



One of the most prolific sources of accident, to say nothing of eye-strain and its effects on health, is improper illumination.



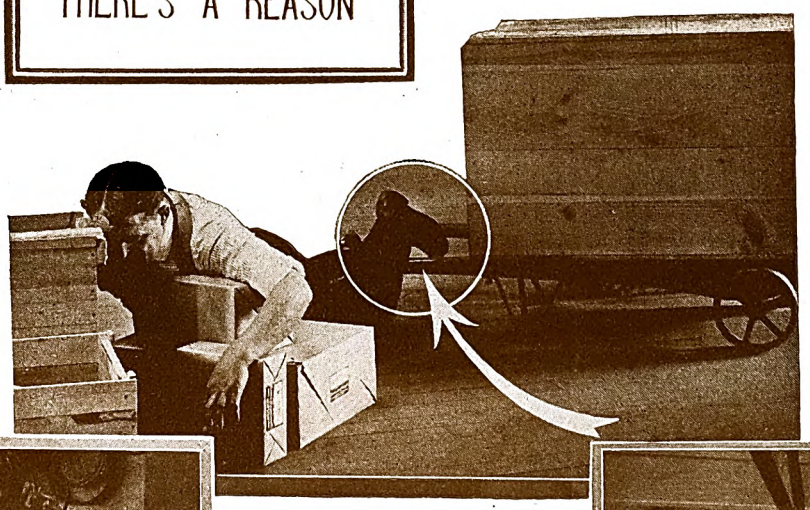
One of the posters used to drive home the idea of proper lighting.

There is a psychological aspect as well as an economic one to this problem. The young man who is injured the first day or two that he is employed is not going to be with that concern very long. If he does not leave of his own volition, he will be persuaded to do so by his family. Unfortunately, one of the curious manifestations of mass psychology in the shops is that if one quits, several usually follow.

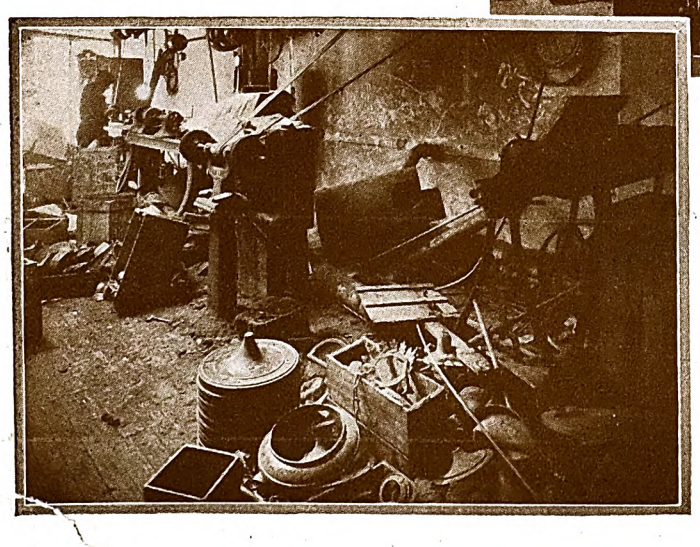
Another important phase of good shop housekeeping is the impression it makes on the applicant for employment. One employment manager of a large plant of national importance told me recently, he has sold the job to the applicant on the plant's cleanliness and appearance, when other arguments have failed. This employment man has one of his assistants take the prospective employee through the shop so that he visualizes for himself the care that is taken to make the shop a safe and inviting place to work.

From the foregoing it may be gathered that good housekeeping in the shop is not only the solar plexus of accident and sickness prevention, but a good selling argument in interesting and retaining the new employee.

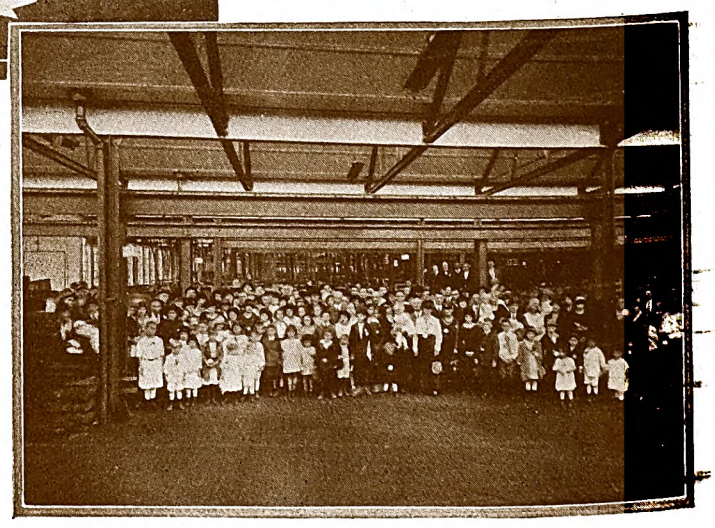
(*Continued on page 68*)



This may be an extreme example—but it happens to be an actual case—of poor housekeeping; an invitation to disease, fire and accident.



Obstructed aisles are not merely untidy; they are a source of constant danger.



Inspection day in a large machine shop.. Frequent inspection is a big factor in stimulating good housekeeping.

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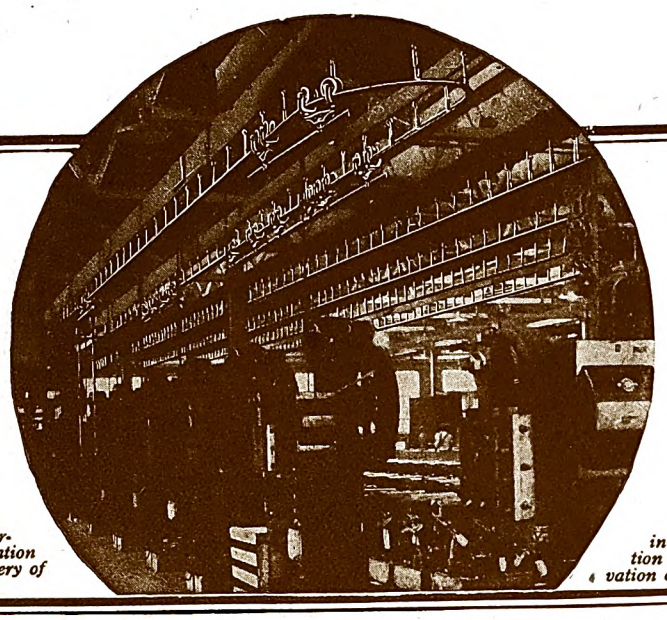
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Analyzing the Foreman's Job

By George W. Gray

"WHAT are foremen for?" asked a lecturer at a recent gathering of factory workers.

"To bawl out their men," answered an Irish voice in a rich brogue. The burst of laughter and applause which followed showed at least that the meeting was in good humor.

"To keep down loafing and soldiering," said another, followed by more applause.

"To hire us and to fire us," answered a third man, and brought down the house.

The lecturer straightened his face and repeated his question. "Think of your own factory and your own experience there," he said, "and tell me what the foreman's job is, as you see it."

"To keep an eye on things for the management," volunteered one man.

"To boss the men in the department," answered another.

"To break in green men and show 'em the ropes," replied another man, an old-timer who was apparently not accustomed to the modern system of shop training departments.

A serious-faced young man who was assistant foreman in a machine shop held up his hand, was recognized, and rose to his feet.

"Foremen," he announced, "are the supervisory force, the squad-leaders of industry, who see that the men do their work with the least expenditure of time and the least waste of material.

Ah ha!—a burner of the midnight oil!

"Foremen," proclaimed another man, in a high-pitched voice, "are the police officers of factory work."

More discipline!

And so it went. Practically every reply to the question reflected in some way on the foremen's handling of his men, on his functions as taskmaster, disciplinarian, leader.

But do these suggestions embrace the whole of the foreman's job? A recent widely-circulated text-book on the subject of foremanship analyzes his functions into six, as follows: (1) to develop his men, (2) to lead his men, (3) to plan and organize the work, (4) to supervise the work, (5) to make improvements, (6) to coöperate with the management. These functions can easily be classified into two groups: those that have to do with the work or technique of the department, and those that have to do with the human element. The foremanship we may therefore define as a two-phase job: it calls for technical ability and managerial ability.

Very little is heard in criticism of the typical American foreman as a technician. Usually he is a skilled man in his line and able to make good in any reasonable test of technical ability. If he is a foreman of a battery of drill presses, he knows drills down to the last intricacy. If he is a foreman of chocolate dipping in a candy factory, or of cold drawing in a steel mill, or of finishing in a furniture factory, or of any other specialty, usually he knows pretty thoroughly the technique and the machinery of his specialty.

It is in handling the human element within his department that the foreman all too often shows his deficiency. The replies of the workmen quoted at the beginning of this article, informal and somewhat hilarious though they may be, give at least a hint on this problem.

The average up-from-the-ranks foreman is not a good manager. Usually he is not picked on any basis of managerial ability, but rather on the basis of technical ability. When the old foreman quits, dies, or is discharged, the usual plan has been to pick the best worker in the department and reward him by promotion to the foremanship. His education and training have all stressed the technique of his work; little or no attention has been given to the managerial functions. It is no wonder,

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therefore, that the average up-from-the-ranks foreman so often falls short of perfection as a manager and leader of his men.

A great deal has been written since 1917 about the foremanship, its opportunities, its shortcomings, and its future. During the industrial emergency which the war brought, we discovered that the foremen are the "non-coms of industry," the "key-men of production," and many were the managers who hastily improvised schemes for the keying-up of their key-men. These efforts ranged all the way from inspirational talks by the management to full-fledged educational courses, with ponderous textbooks, reference reading, lectures, written exams, and a diploma of graduation at the end of the course.

A factory in the West was contemplating the establishment of a foremens training class. The manager, a very conscientious man who had done much reading on the subject and was steeped in theories of industrial education, decided that what his foremen needed was a course of lectures in the history of the company. His organization had suffered from heavy labor turnover during and following the war, and in the manager's opinion the department heads needed to be imbued with the ideals and standards of the business such as a review of its history might give.

When old Colonel Blank, a heavy stockholder and himself an industrial executive of wide experience who had retired, heard of this educational project, he paid a visit to the manager.

"Don't waste any time on history," advised the Colonel. "Show 'em how to call down a man without insulting him, and how to praise good work without lollypopping."

The manager was somewhat nettled but managed to conceal it.

"Why, our force is almost entirely a new crew, Colonel," he explained. "They don't know anything about the past of the company, how it was established, how it has grown, the evolution of our products."

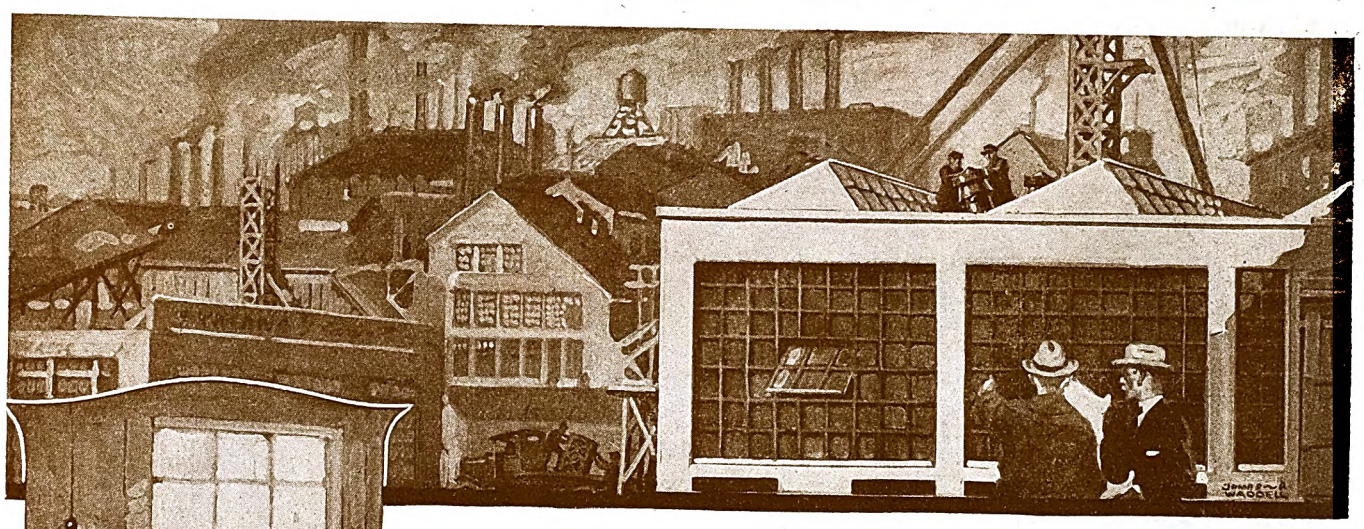
"Does it really matter?" asked the Colonel. "They are skilled in the work, all right, aren't they? They know our present products, and the processes, don't they?"

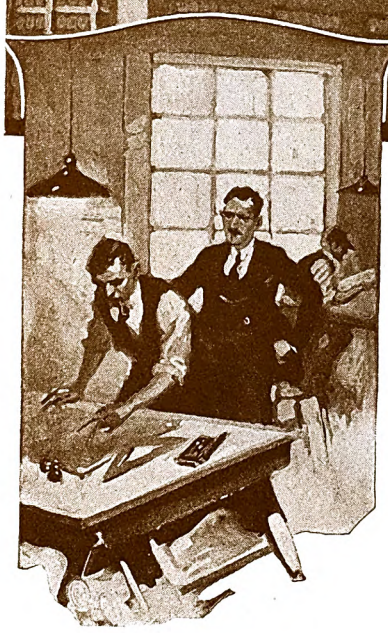
"Yes," admitted the manager, "but they need keying-up. Our labor turnover is enormous."

"And you think if you give 'em a college course in what a glorious concern they're working for, they'll fall to, and cheer for dear old Alma Mater, and nobody'll ever have the heart to quit, eh"

The manager flushed, turned to his desk, and the Colonel left, smiling. The course was never given.

Somewhat at the other extreme is an experience that was told me of a New England factory. It is a large concern with an extensive educational work which had been placed under the charge of a learned specialist who had had considerable experience in college teaching. He organized courses for apprentices and beginners, a course for salesmen, and then decided that the foremen were next. For the foremen's course he conceived something that should be technically com-

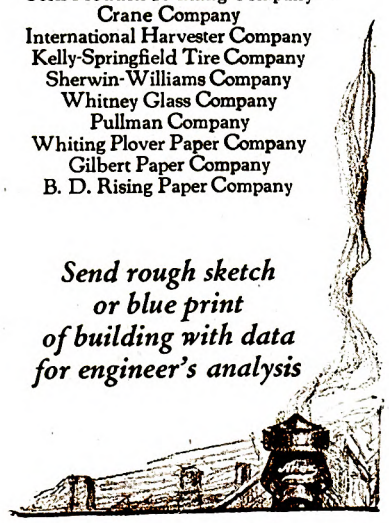




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plete, a course that would round out the foremen and bring them abreast of everything in the industry. He spent a year visiting other factories, consulting authorities in technological schools, selecting the text-books to be used, laying out a schedule of lectures, and planning the system in detail. It was truly a comprehensive curriculum, including mathematics, blue-print reading, physics, chemistry, and machine design, and such allied subjects as economics, sociology, civics, and psychology.

When announcement of this course was made, a committee of foremen waited on the educational director and politely informed him that they would be unable to take it. The foremen said that no doubt they were ignorant of the subjects offered, and might be benefited by the study, but that the factory work was exacting and demanded their time and energies, and they were really too busy to go back to school.

So that educational project fell through, and shortly afterward the educational director resigned.

The foregoing examples are not cited as evidence of the impracticability of foremen training, but as instances of a wrong approach to the problem. The foremen in the New England factory were right in saying that they were too busy to go back to school, for such an education as that outlined for them would have required their concentrated effort, and could hardly have been taken up seriously without borrowing time and energy from their work. Training on the job is not an impossible scheme; in fact, many industrial educators regard it as the best method of industrial training for adults. And there are numerous instances on record of successful results secured through training foremen on the job; results reflected in immediate improvement of their work, their handling of the men under them, and their cooperation with the management. But such results have been secured with courses that are carefully planned to steer as clear as possible of the merely theoretical or academic approach to industrial principles and problems, and to make the training intensive, consistently concrete, and tied up closely to the live everyday problems of the foreman in his department.

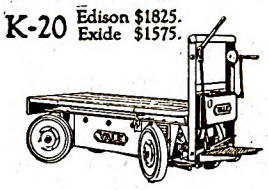
And so too with the project of the manager of the Western factory for a course in company history. These things are all right as incidentals. Inspirational lectures, preachments on company loyalty, and the like may work in with some program of training, but to make them the whole training is rather overbalancing their value. If the foremanship in that plant needed to be improved, the chances are that what the foremen needed most was some instruction and drill in the principles of handling the human problems that arise. The fact that the company was suffering from excessive labor turnover shows that. Whiting Williams found in his sojourn among coal workers and steel workers that a chief source for unrest and labor turnover among laborers is the attitude

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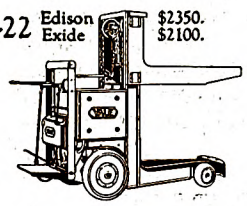
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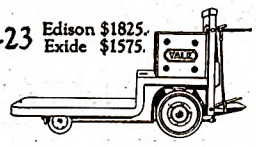
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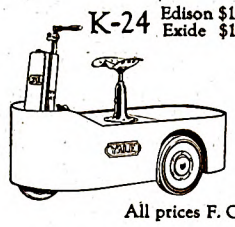
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(*Continued from page 30*)

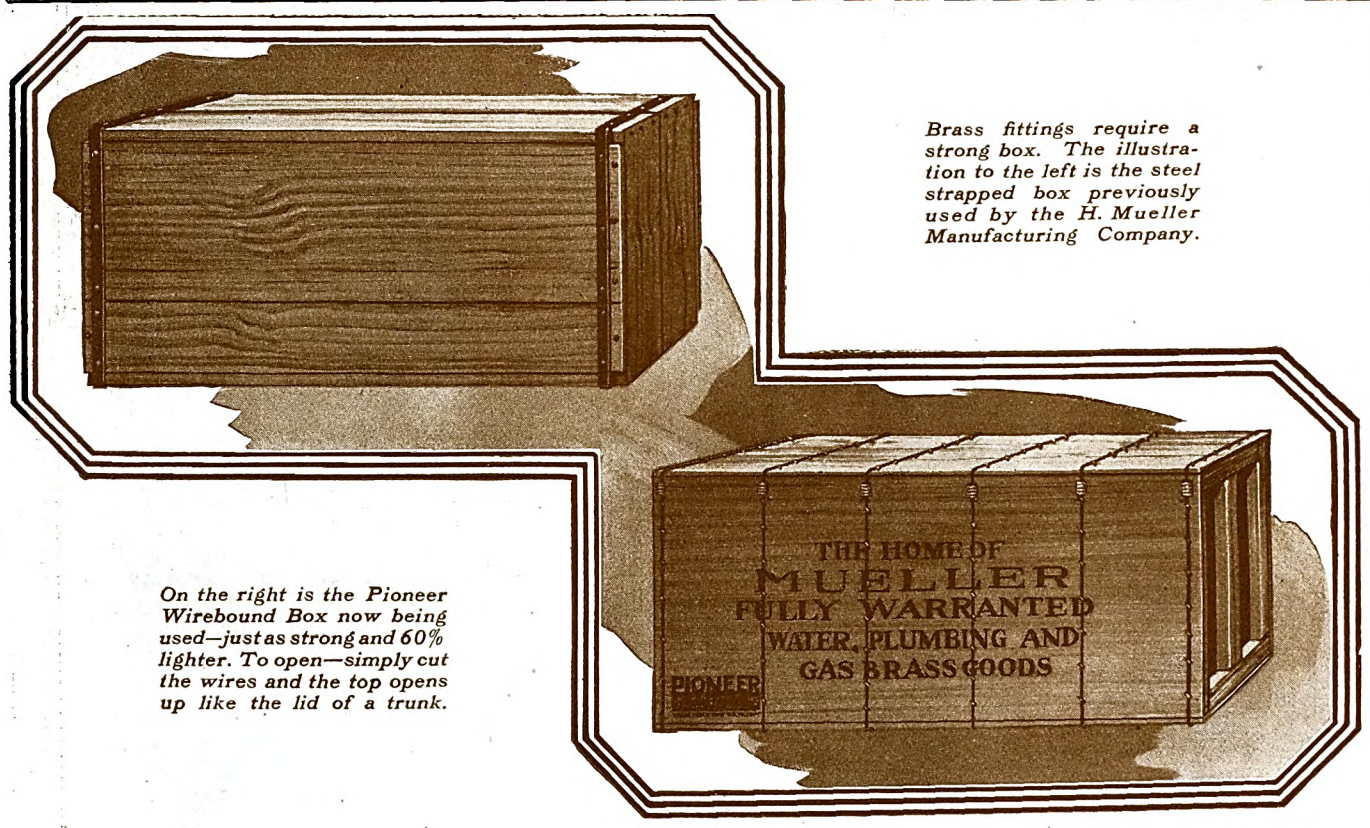
and treatment they receive at the hands of their foremen.

Another point on this question of what kind of training for the foremen, is the fact that foremen do not take readily to a program of technical study. Some do, of course—there are exceptions to every statement made in this article—but I am speaking of what is common and prevalent. If an educational expert, either from the inside or from outside the organization, comes forward to teach technique, the typical foreman looks at him askance. "What's he know about it? What right has he got to come here and teach me something I've known all my life?" And so on. The reaction is at once one of suspicion and resentment.

But come to the foreman with a program that takes up questions of handling men, of management, of industrial fundamentals, and at once you arouse at least curiosity. After that it is altogether a problem of handling the thing right, of conducting the training in a way that will upbuild the foreman's confidence. The typical foreman, if he has any ambition at all, feels his lack in these directions. He will instantly resent any reflection on his skill as a machinist or a craftsman; but he will be willing to listen to you on a question of how to discipline an unruly workman. The latter is an open question with him, and if he is honest at all he is willing to admit his limitations and welcome light on the subject.

The modern approach to this problem of improving the foremanship seems to proceed on the basis that the prime need of the foreman today is facility in handling men. Efficieney of labor is the secret to efficient production. We talk a lot about the cost of labor turnover, but who knows what the real cost is? Men are lost, new men are hired, and a certain amount of money is spent breaking them in, training them to their new jobs. It is possible perhaps to figure the cost of the employment department, and the cost of the training department. But how can you figure the difference between the old, experienced worker and the new? How can you get down in terms of the adding machine the elements which enter into production by a stable, experienced, competent force, and those that enter into production by a constantly shifting force? Industrial unrest is not always a question of wages, of hours, of unionism. Many a factory turmoil can be traced back to bungling foremanship, many a bitter strike has had its roots in the sharp tongue and offensive attitude of some foreman who was a good technician, perhaps, but a rotten manager of men.

"The friendliest kind of relations between executive and employees, the most careful employment methods, may be wiped out and a high labor turnover piled up by a tyrant foreman," said the general manager of a large Connecticut industry. "The most patient study of operations and the most scientific reorganization of working methods may be entirely wasted by the foreman who tells his men to "fergit it" when the reorganizers are on the other side of the door. The most enlightened and earnest labor policy may be distorted into an object of



Brass fittings require a strong box. The illustration to the left is the steel strapped box previously used by the H. Mueller Manufacturing Company.

On the right is the Pioneer Wirebound Box now being used—just as strong and 60% lighter. To open—simply cut the wires and the top opens up like the lid of a trunk.

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THE H. Mueller Manufacturing Company for years used excellent wooden boxes, strong, well-made, steel banded—but expensive and heavy.

After General Box Engineers had analyzed their shipping requirements the Pioneer Wirebound Box, weighing but 40% as much as the old box, was recommended, tested out and adopted.

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In addition, the H. Mueller Manufacturing Company provided their customers with a container that could be opened in a few seconds without damaging the box and could be unpacked quickly and re-used.

In this instance the total savings made possible by this new container were very much worth while. It is a fair example of what might be done for you.

Our box engineers will be glad to study your requirements and offer suggestions. If you cannot use Pioneer Boxes or Crates they may be able to help you with other ideas. We make all kinds of wooden shipping containers.

Through our sixteen factories we can give you close at hand service. A bulletin on boxing and crating—"General Box Service"—will be sent free upon your request.

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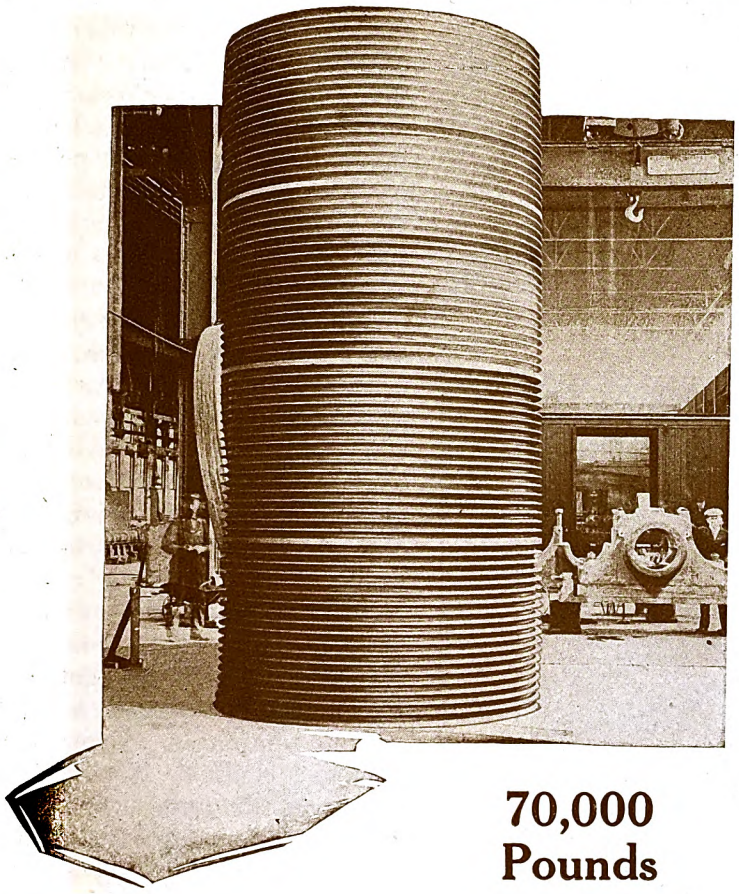
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bitterness and resentment by a few words from a cynical foreman with a grouch.

One solution of the foremanship problem, then, lies this way: To provide stimulation, encouragement, training, enlightenment, to foremen in these directions of their greatest need, rather than to drain off energy and deaden interest by learned dissertations on highly technological subjects.

There is a factory in Illinois which has had some extremely successful results with foremen training, and the superintendent there has described his system as one of "making the foremen into diplomats." The emphasis here is on the foreman's problem of handling the men under him. The training course defines different types—the grouchy workman, the swell head, the over-ambitious, the timid, and so on. Methods of dealing with these different types are illustrated and described. There are examples of how to handle various typical grievances, how to reprimand a man tactfully, how to call his attention to some fault, how to appeal to loyalty, how to win coöperation. It is really a training in applied psychology—though no such forbidding name is used. The superintendent of this factory recently said that foremen training last year doubled the production efficiency of his organization.

Where the foreman so often fails—in his handling of his men—is just the place where he can make his most conspicuous success. Mr. B. M. Nussbaum, the well-known authority on foremen training, was telling recently of an exceptional example of a foreman functioning in a way that would have done credit to the most expert personnel director.

It happened in a Detroit machine shop. The shop was making templates to order on a contract that called for precision work—the templates had to fit to five one-thousandths of an inch. The first deliveries were made, and at once a large batch of the templates were rejected and returned as imperfect. A quiet search was made by the foremen, and the faulty work all traced to one mechanic. It was no time to fire the man, for skilled labor was scarce, the contract was a large one, and the fac-

Points Out Any Shortcomings

in men or machines

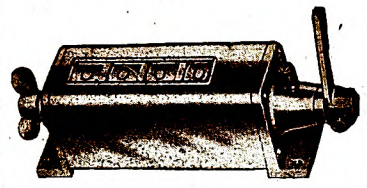
Point at a workman's production-record, or a machine's rate of work:—you will make your point! The record will be improved if it *should* be.

Your presence at the machine isn't demanded. A Veeder Counter will represent you, and get the results *due* you.

In developing production (human or mechanical), what's required of the man and *possible* for the machine may be *HAD* with a

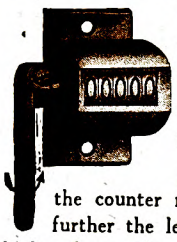
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The Set-Back Rotary Ratchet Counter below is for machines such as presses and metal-stamping machines, where a *reciprocating* movement indicates an operation.



Registers one for each throw of the lever, and sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figures, as illustrated, $11.50—subject to discount. (*Cut less than ½ size.*) Set-Back *Revolution* Counter of similar model, $10.00 (list.)

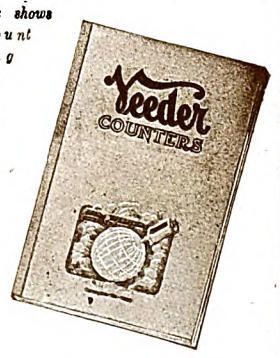
This small Rotary Ratchet Counter (No. 6) counts reciprocating movements of the lever, as required for recording



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tory was running at full capacity. The foreman, however, knew his man and believed that it was simply a case of carelessness.

The next morning the foreman stopped at the workman's machine. "Just wanted to see how you get your results, Bill," he said, as he stood by a few moments and quietly watched operations. Of course Bill did his best and turned out perfect templates while the boss was watching. The foreman tried out several of the templates with his micrometer, and smilingly nodded his approval.

Later in the morning the foreman happened up unexpectedly. Bill didn't know he was anywhere around until he was right there, smiling a greeting, and picking up one of the latest templates. He tested it with his micrometer. His face showed amazement. He picked up another one, tried it, and shook his head. "What's up, Bill?" he asked. "These are 'way off. Something's wrong somewhere." Bill looked embarrassed. He had been caught and he knew it. But the foreman took no notice of this. His attention was all for the faulty templates. "Watch this work mighty close, won't you, Bill?" he asked, as he put the micrometer in his pocket. "We're working up to exact specifications on this job, and they check us up close at the other end. Anything that's off the least mite is rejected, and you know what that can mean on a big contract like this. Keep up the lick you were going a while ago, and we'll be all right. And, for goodness sake, Bill, don't let a single one of 'em get by you wrong."

Around noon the foreman paid his third visit to Bill's machine. Again he got out his micrometer, tested several of the templates. Every one was just right. "Not a single one over or under, Bill," he said with smiling enthusiam. Bill grinned.

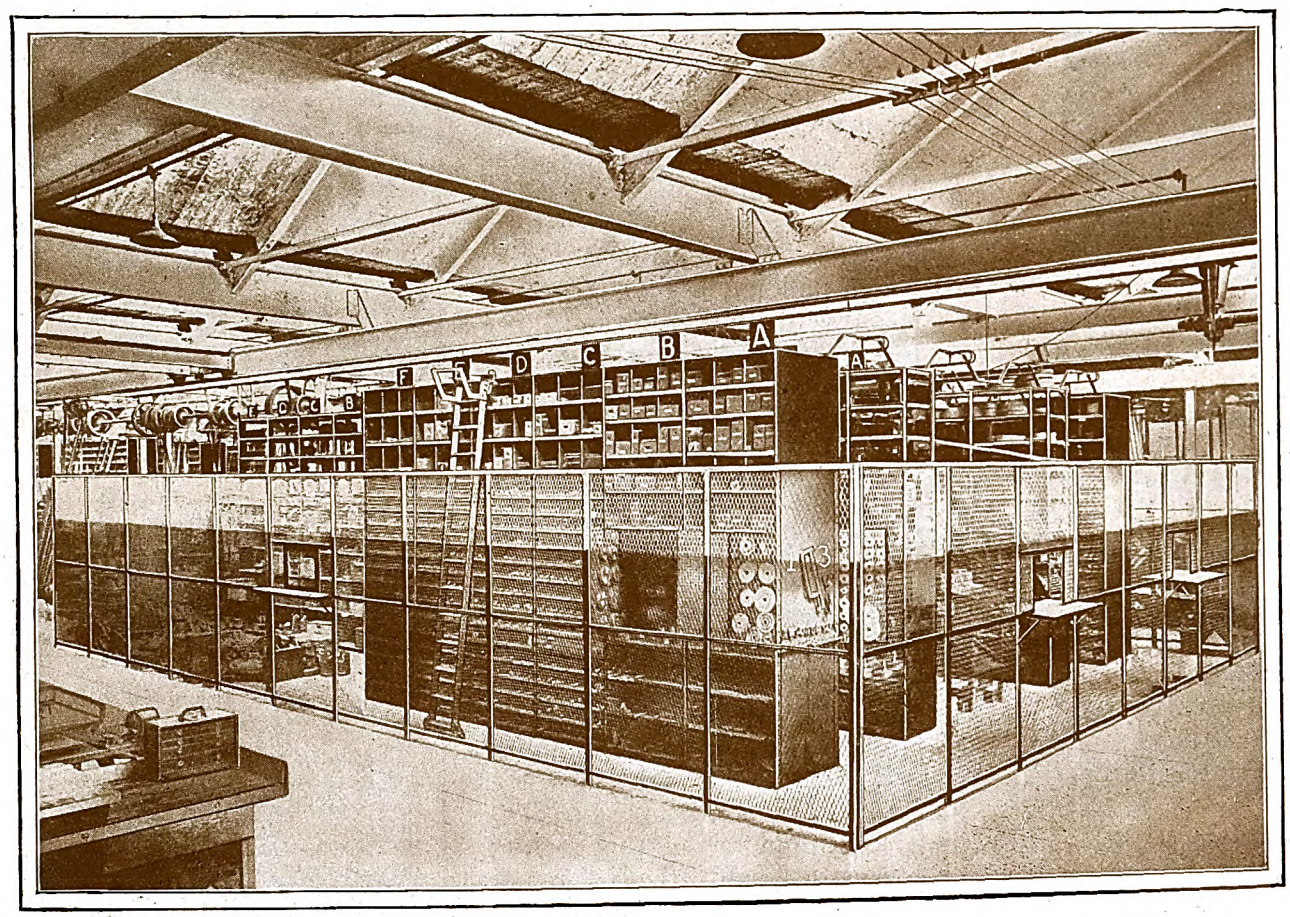
"I knew you could do it, Bill," said the foreman. "Some of 'em wanted me to fire you, but I couldn't lose one of the best men I've got."

Bill's face showed his amazement. "Wanted to fire me! What do you mean?"

"Some of the templates were rejected, and they happened to be a part of your production," answered the foreman. "But I felt sure it was an off day, maybe, or some trouble that was bothering you. For I knew the sort of workman you are, and the kind of work you can turn out. And I've proved I was right, Bill, and mighty glad of it."

That little episode proved to be the redemption of Bill as a workman. Bill's work since then has been of the highest quality, and as for loyalty—nobody could be a stronger adherent of a leader than Bill is for his foreman.

Foremen who can handle situations tactfully and yet firmly are the foremen who can reduce labor turnover, decrease shop loafing, eliminate wastes, and speed up production. All of these things depend to the greatest degree upon the human element in the factory. Wherefore the importance of the foreman who is tactful as well as a tactician, who is a diplomat, who is—if you please—an applied psychologist.



There is Double Economy in Lyon Service

ELEVEN years ago the Landis Machine Company, Waynesboro, Pennsylvania, sent for a Lyon representative to explain the advantages of Lyon Steel Shelving.

After doing so, the representative studied their stores requirements from the standpoints of immediate accessibility of materials — the relation of the stores system to the production and receiving departments — and the probable development of the business.

A complete stores plan was submitted and adopted. It has worked out very satisfactorily.

Since then the Landis Machine Company, one of most modern machine tool plants, has placed with us about thirty orders for Lyon Steel Shelving. These additions to the original installation were made without inconvenience of any sort— due to a well-conceived. well-executed stores plan and to the standardized nature of Lyon Steel Shelving that simplifies expansion of the stores system.

This instance typifies the double economy in Lyon Service. The economy of intelligent planning and the economy of steel shelving of recognized quality.

We will be glad to give you full details of Lyon Service and show you evidence of what we have accomplished for other manufacturers—if you will let us know you are interested.

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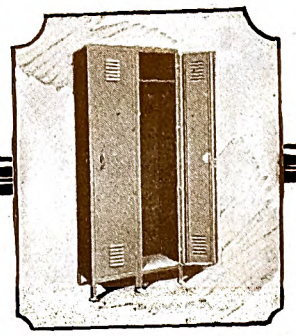
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Plugging the Power Leaks

(*Continued from page 18*)

life of the equipment greatly increased, if the boilers and auxiliaries were not crowded beyond the limit of their capacity. In such instances the addition of another unit to relieve the overheated plant would be a paying investment and would reduce the excessive wear and tear to a marked degree.

The cost of stoker and grate renewals is invariably increased by the burning of poor and unsuitable grades of coal. High-sulphur coal is particularly objectionable, in that it readily fuses with the small cast-iron parts. In a short time the entire grate area has deteriorated and requires replacement.

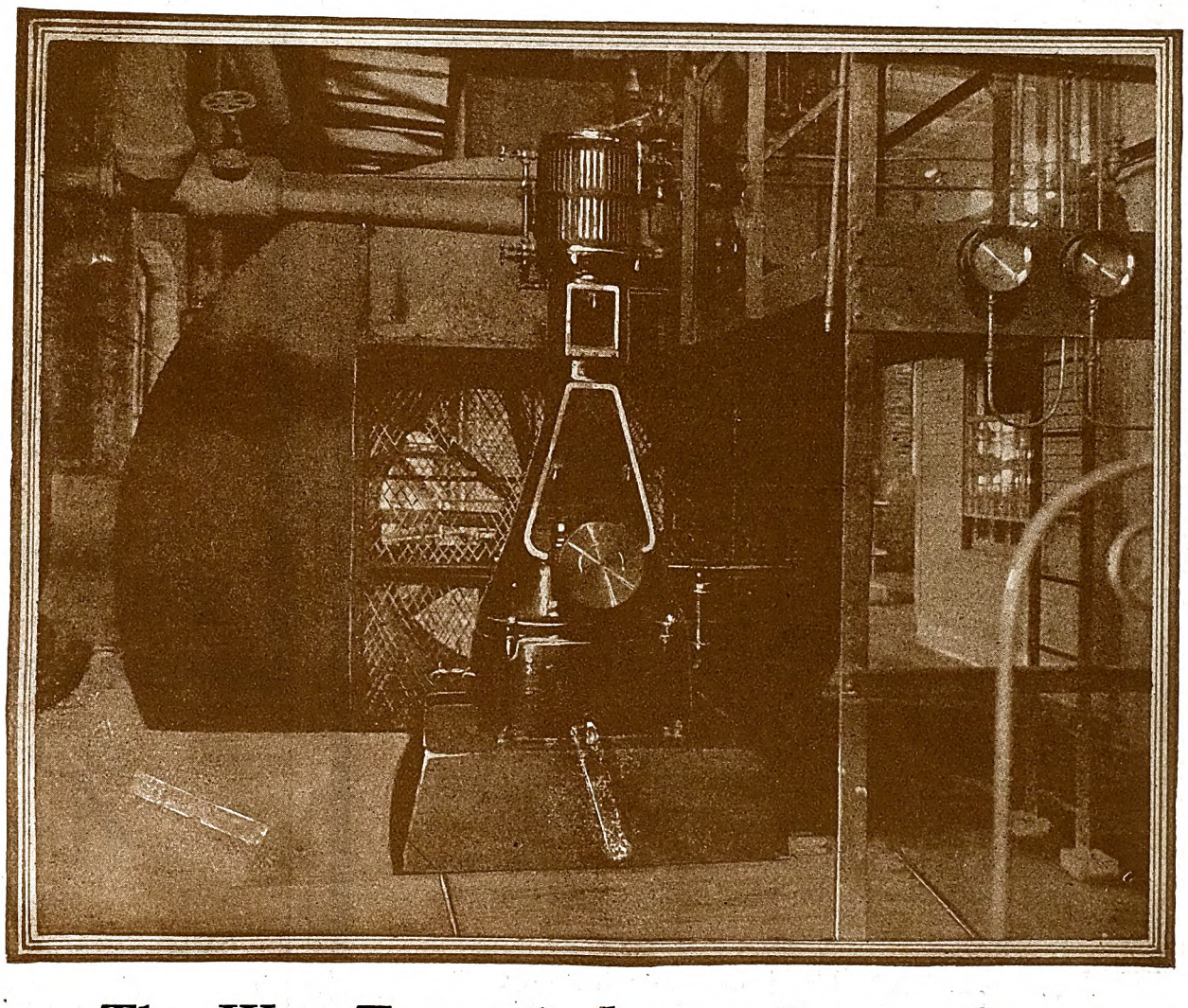
Modern high-temperature brick has made possible material reduction in the maintenance costs of boiler furnaces. It sometimes happens, however, that in forcing the boilers beyond their proper capacity the draft fans are speeded up to a point where furnace pressures are developed. These pressures force the hot gases of combustion into every crack and crevice of the setting, melting the brickwork and often weakening the supporting ironwork. Suitable draft gages for indicating draft and pressures over the fire bed give a visual indication of any tendency for pressure to build up and enable the firemen to avoid the danger point.

When more than one boiler is on the line, each contributes its share of steam in proportion to the heat liberated in their respective furnaces, *i. e.*, in proportion to the condition of their respective fuel beds. Some boilers will, therefore, assume the bulk of the plant load, while the poorly-fired boilers will be "loafing." Boilers developing low capacities are operating uneconomically and are "coal-wasters." When indicating steam flow meters are mounted upon each boiler front the capacity developed by each unit will be visible from the firing floor and the uneconomical boilers can be brought up or cut out of service, as the conditions may warrant.

The importance of heat conservation in the feed water system is often not appreciated and the neglect of this factor results in an appreciable preventable waste. The writer has in mind an amusing incident, which indicated a laudable pride as well as a woeful ignorance on the part of the chief engineer of a certain New England plant.

In this particular plant the brass feed water piping ran from the feed water heater across the boiler fronts, with a branch to each boiler. The chief took particular pride in his boiler house and kept it scrupulously clean. In his spare moments he had polished the brass pipe, which carried several million B. t. u's of good hot feed water, until it looked like "Sunday." He was quite chagrined when we suggested that, if the manager didn't want to buy insulation

(*Continued on page 37*)



The Way Towards Lower Power Costs Suggests TROY ENGINES

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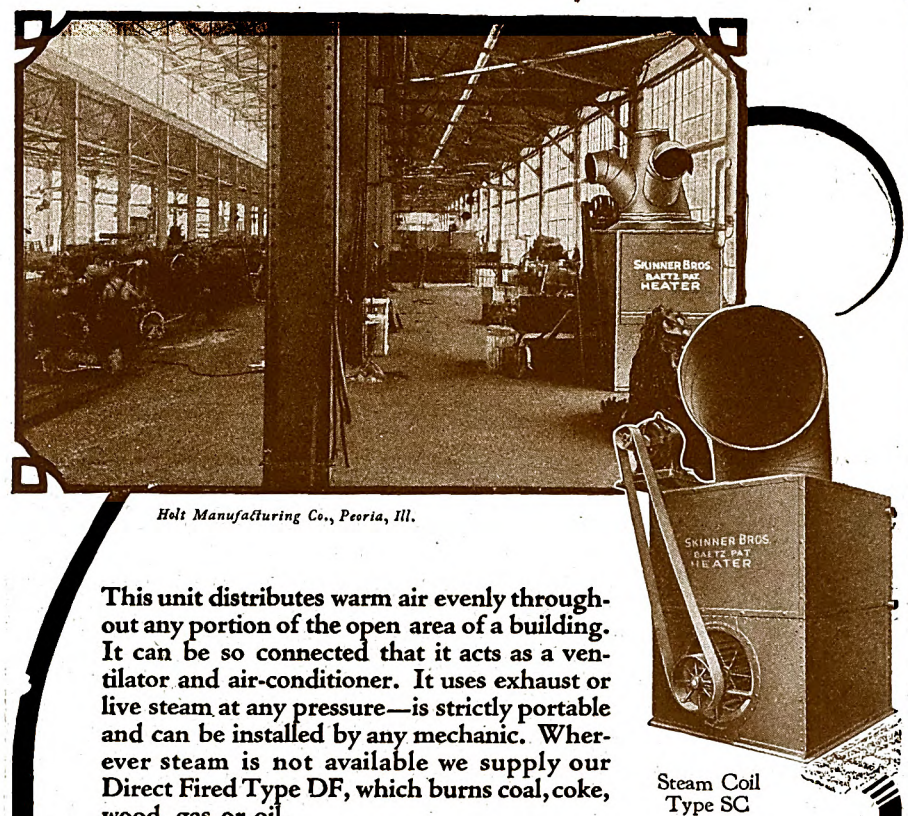
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Here is a real operating economy—the Skinner Bros. (Baetz Patent) *Heater* is also a *ventilator* It actually keeps every part of your building at a comfortable working temperature and at the same time can be used to supply pure fresh air in any quantity desired.

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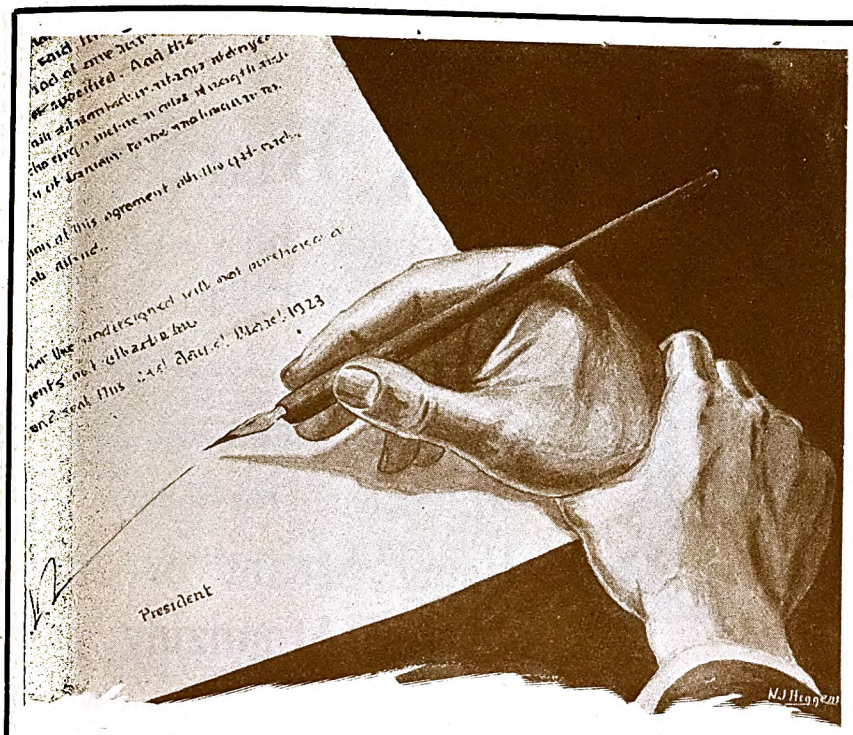
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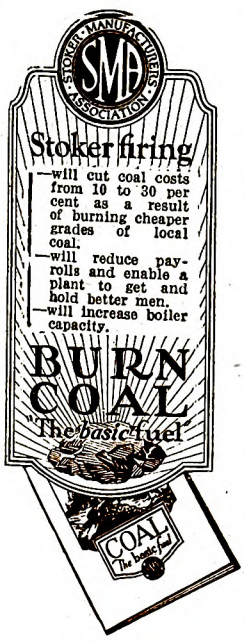


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EIGHT chances out of ten you are not buying the cheapest fuel that will operate your plant satisfactorily. And, just as likely, you are buying at least ten per cent more coal than you would need if your plant were scientifically fired by full fledged mechanical stokers. Is a saving of ten to twenty-five per cent of one of your largest items of operating cost worth careful consideration?

The Country's most prominent combustion engineers are ready to show you which fuel you should burn and how you should burn it. You can have this counsel without cost or obligation by referring your entire combustion problem to the capable engineering staffs of the well-established manufacturers of mechanical stokers.

If you want to save coal and labor, and in doing it have a smokeless stack in the bargain, investigate the possibilities of scientific combustion. Do it before you pay another coal bill or sign another coal contract. The informative book, "Coal—The Basic Fuel," will give you a good idea of the scope of scientific combustion.



Read why you should burn coal and how you should burn it.

Stoker Manufacturers Association

Mr. G. A. SACCHI, Secretary Stoker Mnfr's Ass'n

Lester Branch, Philadelphia

(Continued from page 35)

for the feed water lines, the next best thing would probably be a good healthy layer of dirt. But bright, shiny brass made about as good a radiator of heat as anything we could think of on the spur of the moment. It nearly broke the chief's heart when he covered that feed line with insulation, but it must have saved some coal.

Automatic feed water regulators render valuable assistance in maintaining continuous steaming and high economy in boiler operation.

With hand feeding, large volumes of relatively cool water are suddenly introduced into the hotter boiler in a short period of time. The result is that the boiler suddenly stops making steam for the time being. The inefficiency of this method multiplied by the many times this operation is performed daily results in another loss which is appreciable over a period of time. Some stations have found that automatic feed water regulators also reduce boiler room labor costs, in that it is possible to release one or two water tenders for other duties.

The necessity for blowing down boilers at frequent intervals, due to the use of bad feed water, causes losses that are sometimes unnecessarily large. When it is not possible to remove harmful impurities from the boiler feed before it enters the boilers, these losses may be minimized by opening the blowoff valves no oftener and no longer than is absolutely necessary.

No accurate knowledge of the location and magnitude of boiler room operating losses can be had without suitable indicating, recording or integrating instruments. Without such knowledge continuous and permanent economies are difficult, if not impossible, to attain. Proper instruments are as necessary, therefore, to the plant engineer as are the clinical thermometer and stethescope to the physician. They furnish the information, which, if intelligently interpretated, will assist in diagnosing the operating ailments and in prescribing the proper remedy.

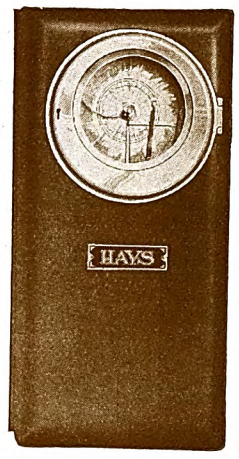
One of the most common and most wasteful features in the distribution of steam through-

(Continued on page 39)

Eliminating

"I guess"
"I believe"
"I suppose"

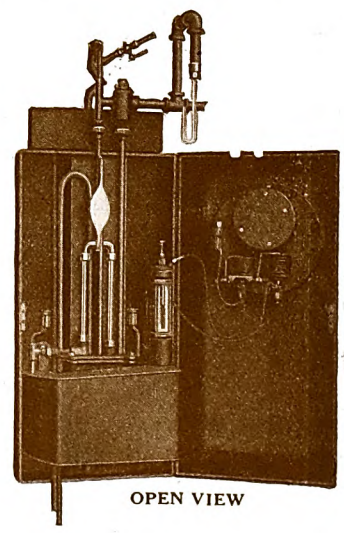
from the BoilerRoom!



Put your firemen in a position to know what to do and how and when to do it. It will mean far greater efficiency in the boiler room and save you money. Don't force the firemen to go by "guesswork". A daily chart from the Hays Automatic Co2 & Draft Recorder will supply the information at the time it is needed.

The Hays Automatic Co2 & Draft Recorder (Model B) is the last word in being the most practical and simple in construction and operation. Any ordinary unskilled laborer can operate it. The Standard recorder will chart the percentage of CO_2 contained in the waste gases from the boiler furnaces, stills, kilns and also the draft over the fire. The standard range is O—20% CO_2 and O—1 inch water draft. Attachment can be provided for Double Draft Record to show draft loss through tubes as well as draft over fire and in last pass.

Special recorders are furnished for SO_2 or other acid gases and CO_2 recorders of any range other than O—20%, on short notice.



OPEN VIEW

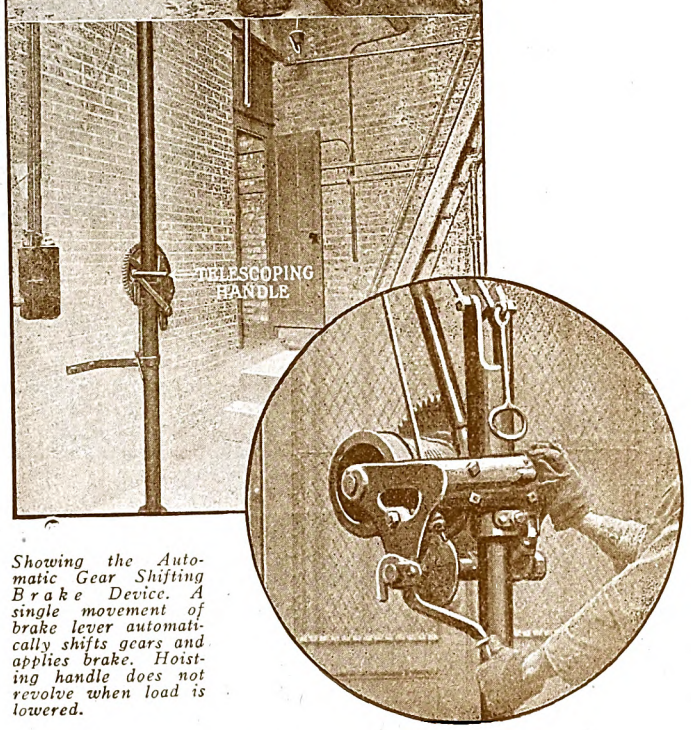
The Jos. W. Hays Corporation
Combustion Efficiency Appliances

1042 E. 8 ST. MICHIGAN CITY, IND.

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Model B Hoist at W. W. Astor Bldg., 323 Fifth Ave., New York City; John F. Burrows Architect. Can is emptied into wagon without rehandling at grade level.



Showing the Automatic Gear Shifting Brake Device. A single movement of brake lever automatically shifts gears and applies brake. Hoisting handle does not revolve when load is lowered.

Simple to Operate Little Effort Required

THE Model B G&G Telescopic Hoist raises load by hand power and lowers by gravity. To raise average filled can of ashes requires only a pressure of 12¼ lbs; on hoisting handle. In lowering, just enough pressure on brake handle is needed to check descent. Complete G&G ash removing equipment as illustrated includes Hoist, Sidewalk Doors, Spring Guard Gate, Door Opening and Closing Device, Operator's Ladder, Swing Bail Ash Cans, and Ash Can Truck.

If you will tell us what loads you are handling, our Engineering Department will be glad to recommend the model best suited to your individual requirements.

Write for booklet "Industrial Plants Need this Hoist."

GILLIS & GEOGHEGAN

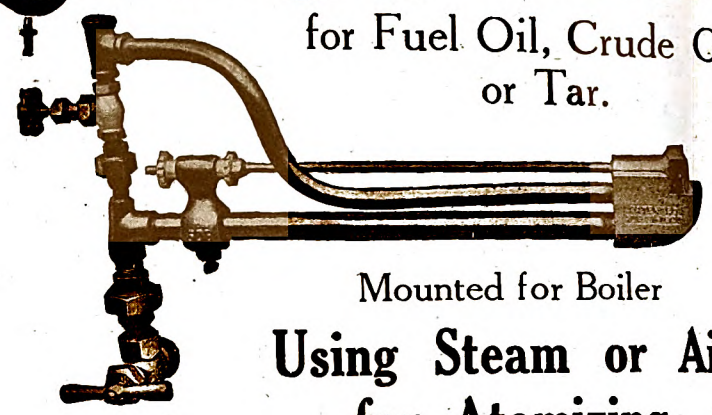
556 West Broadway **New York City**

The **G&G** REG. U.S. PAT. OFF.

Telescopic Hoist with Automatic Gear Shifting Brake Device and Silencer

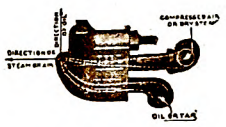
CALOREX Burners

for Fuel Oil, Crude Oil or Tar.



Mounted for Boiler

Using Steam or Air for Atomizing



CALOREX Unmounted

Note direction of arrows. The air or steam meets the oil at right angles, thus thoroughly atomizing the oil externally. This prevents *Clogging or Carbonizing.* The burner is always clean.

WE HAVE been manufacturing liquid fuel burners for the past 33 years and we can safely say that the "CALOREX" is the most economical fuel burner to operate.

The "CALOREX" is simple in construction—no parts to wear out. It will last a lifetime.

It gives the most economical way to change boilers from coal to liquid fuel.

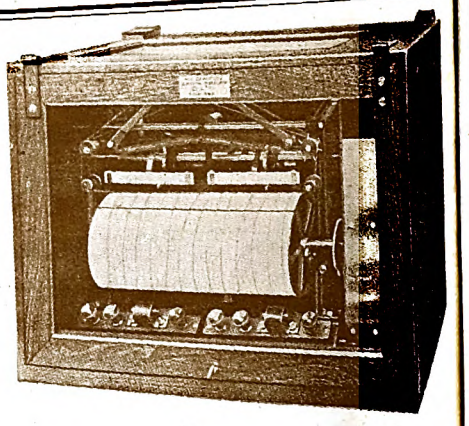
Write for catalog.

W. N. BEST FURNACE & BURNER COMPANY

11 Broadway ENGINEERS IN CALORIC **NEW YORK**

There is nothing better than the Best

Co_2 Readings from 4 Boilers on the One Chart



Helps Solve an Important Boiler Room Problem

A 4-Point CO_2 Recorder—one of the types of Cambridge Recorders, made to show the comparative efficiencies of four boilers.

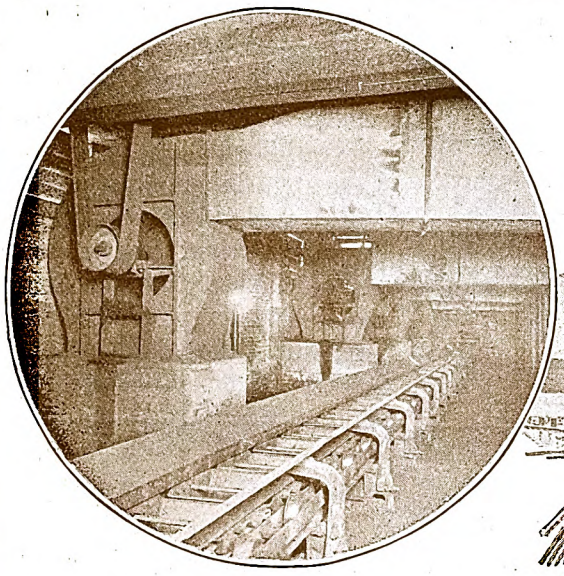
CAMBRIDGE ELECTRICAL CO_2 RECORDERS INDICATORS

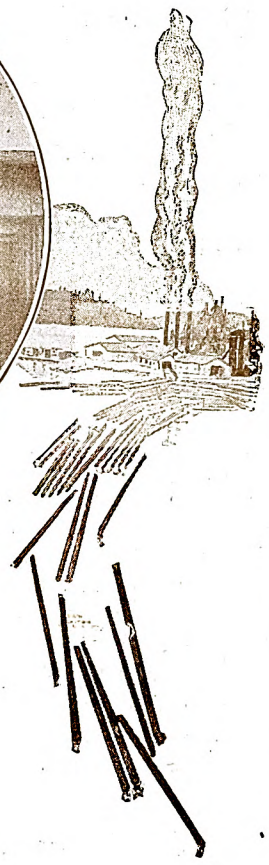
Save time by having a continuous record of boiler performance right in front of the operator.
They are entirely electrical—no chemicals to renew—no glass or rubber parts to break or wear out. Can be installed any distance from the flue. As accurate as an Orsat with none of its faults or maintenance troubles.
Other Cambridge instruments—Electrical Distance Thermometers. Thermo-electric Pyrometers, Optical Pyrometers, Draft Gauges.
Send for List 157 X.

The Cambridge and Paul INSTRUMENT Co. of AMERICA (INC)

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Answering the forced draft problems of every industry

Every industry has different conditions to meet, different problems to contend with and Clarage Engineers have an answer to Every one.

Here six giant Clarage blowers are working in the plant of the Mac Sim Bar Paper Company at Otsego, Michigan. This is one of the many different installations of Clarage Blowers in every part of the country, and but one of the many kinds of work they are doing.

They are serving in the steel plant, the manufacturing plant, on railways, everywhere that forced draft is required. They are moving light materials, drawing off dust, supplying fresh air, removing condensation, exhausting paint fumes and doing countless other jobs at low cost. Engineers have found that they are solving the problem of economy, answering the demand for constant, faultless service and increasing plant efficiency in every installation.

Send for the booklet on moving air. It will tell the whole story.



Offices in principal cities.

CLARAGE
FAN COMPANY
FANS~BLOWERS~EXHAUSTERS
KALAMAZOO

Clarage Fans are built in types and sizes for every service.

(*Continued from page 37*)

out the average industrial plant is the bare steam line. Some day, when you are out in the plant, pick out the steam lines. How many are covered; how many, partly covered; and how many, with no insulation at all? Many plants are satisfied with insulating everything except flanges, valves and fittings. Count up the number of uncovered flanges and fittings in your plant. Multiply them by one and you will have the number of tons of coal they are costing you every year.

It is common practice in the layout of industrial plants to run steam lines haphazard and to cut in with branch tees wherever they are needed. The result is that the pressure drop between the departments where the steam is used and the boiler house where it is made gradually become larger as the plant grows in size. The line and condensation losses increase. Fortunate, indeed, is the plant with a Master Mechanic whose vision carries him beyond today into tomorrow and who plans his piping to meet the future growth of the plant.

In many cases poorly designed steam lines cause excessive vibration. This is especially the case in main steam lines where large volumes of steam traveling at high velocities, must make sharp right-angled turns. Such vibrations cause a gradual weakening of the joints and of the pipe supports and result in unnecessary maintenance and repair costs. Sometimes the installation of a large receiver reservoir in the steam line will act as a cushion to absorb the vibration and nullify the ill effects that would otherwise be produced.

Compared with the boiler house, the engine room is an economical and efficient department. It usually has the benefit of closer supervision on the part of the engineer. It is clean and offers more in the way of comfort and convenience than does the boiler house.

Where the equipment is old, however, there is apt to be considerable steam loss due to poor condition of steam engine valves and improper setting. Worn piston rings and scored cylinders cause a further loss of power.

Where the supply of exhaust



Plibrico eliminates this!

WHEN furnaces are lined with fire brick, it is not long before the flame attacks the joints, causing the bricks to crack and spall. Soon they crumble and fall out, and the entire lining goes bad and allows heat to escape—just like the lining in the photo above.

Plibrico Furnace Lining eliminates this. Plibrico is pounded into place while plastic, and forms a jointless lining—a lining that lasts two to four times longer than fire brick, that resists heat to 3100 deg. F., and that cuts down heat radiation. It is ideal for ignition, front door and rear combustion arches and special shapes because it can be applied to any shape. Unskilled labor installs it—with mallet and trowel.

Plibrico is delivered only in steel containers of distinctive appearance as shown below. Warehouse stocks in over sixty cities in the United States and Canada: see phone books.

PLIBRICO
FURNACE LINING
JOINTLESS FIRE BRICK CO.
1154 CLAY ST., CHICAGO

Book Free

Ask for the 50 page "Modern Furnace Building." It will point the way to lower furnace costs—and greater profits.



Jointless Fire Brick Co., 1154 Clay St. Chicago.

Please send me the 50-page booklet, "Modern Furnace Building"—no obligation.

Firm.....

Address.....

.....

Name.....

Position.....

Ind. Ill. 9-23

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steam exceeds the needs of the plant for heating and other purposes, the need for engine room economy is important. Indicator cards taken at regular intervals give a reliable check on the economy and performance of the engine.

In the various plant departments there are many opportunities for steam losses, due largely to the lack of familiarity of the operators with steam engineering principles. Properly designed traps are one of the greatest aids to steam conservation, provided they are of ample capacity, correctly installed, regularly inspected and properly handled. If practical, it should not be permissible for foremen or operators in the production department to tamper with them. The duty of trap inspection and repair should be delegated to one or two men who are thoroughly familiar with their proper operation. In the case of a large manufacturing concern in Pennsylvania, it was possible to cut coal costs nearly 15 per cent. by proper operation and responsible inspection of the steam traps.

There are many cases where live steam is used for drying where exhaust steam would serve the purpose just as well. Live steam is expensive and its use in such cases is a total loss. Exhaust steam, which has already passed through the engines and has rendered its return in the generation of power, is a by-product. Any further use that can be made of it represents a saving and the plugging of another leak.

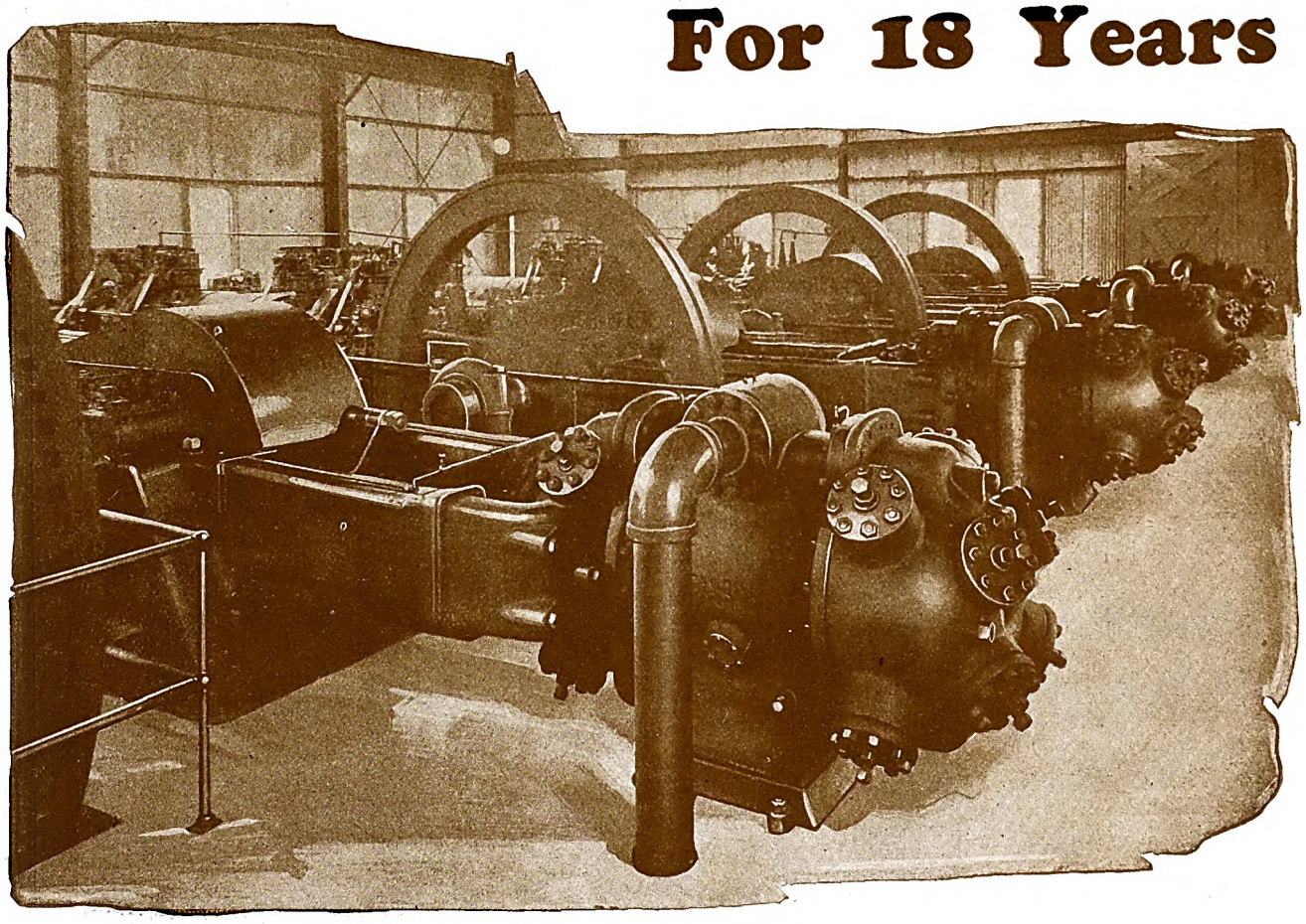
One of the chief uses for exhaust steam in industrial plants is in the heating of the buildings in the winter. Unless these heating systems are correctly designed, however, an excess amount of exhaust will be required, there will be less surplus for the process work and expensive live steam will have to be used to fill the deficiency. Strange to say it is not uncommon to see heating coils running along the upper part of a wall. They might just as well be on the outside of the building. The exhaust steam used heats the roof and the floor stays cold. The wasted steam could probably be put to a profitable use elsewhere in the plant.

In some plants a supply of waste hot water is available. The addition of a circulating pump often makes it possible to use this water in a forced hot water circulation system of heating, thereby reserving the exhaust steam supply solely for process work and, perhaps, eliminating the need for live steam at all.

In every heating system clean radiating surfaces are essential to economy. Dirty surfaces insulate heat. Where exhaust steam is used, therefore, separators of adequate size are necessary to remove any lubricating oil that may be carried in suspension in the steam as it comes from the engine cylinders. Otherwise the metal surfaces become coated with an oily deposit and the efficiency of the heater is reduced. The piping in the average industrial plant consists of a maze of valves, elbows, tees and nipples. If the foreman in Department "T" wants a vacuum pump a new branch is cut into the already

(Continued on page 42)

Worthington Gas Engine Has Run For 18 Years



In 1905 a Worthington gas engine was installed in the Folsom, West Virginia, plant of the South Penn. Oil Co. There is nothing spectacular about this part of the story but—at this date, after eighteen years' regular service this same engine is running, and the fact that it still has all four of the original cylinders is evidence of careful design, fine workmanship and the selection of the best materials used in its construction.

WORTHINGTON PUMP AND MACHINERY CORPORATION

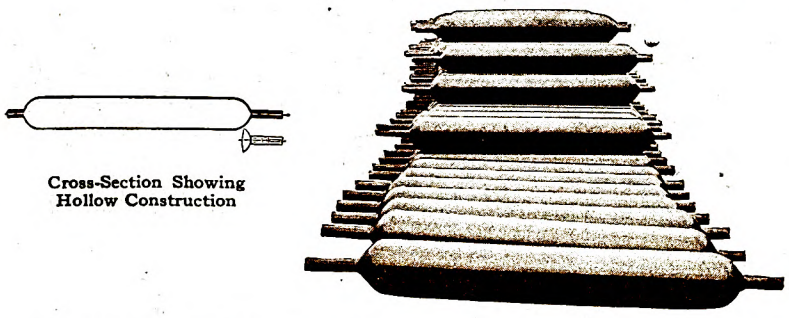
Executive Offices: 115 Broadway, New York City. Branch Offices in 24 Large Cities

W-194.8

WORTHINGTON

Deane Works, *Holyoke, Mass.*
Blake & Knowles Works *East Cambridge, Mass.*
Worthington Works *Harrison, N. J.*
Laidlaw Works, *Cincinnati, Ohio.*
Hazleton Works, *Hazleton, Pa.*
Gas Engine Works, *Cudahy, Wis.*
Power & Mining Works *Cudahy, Wis.*
Snow-Holly Works *Buffalo, N. Y.*
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Cross-Section Showing Hollow Construction

SEAMLESS DRAWN STEEL HOLLOW ROLLS

For Conveying Systems, Steel Mill Tables etc.

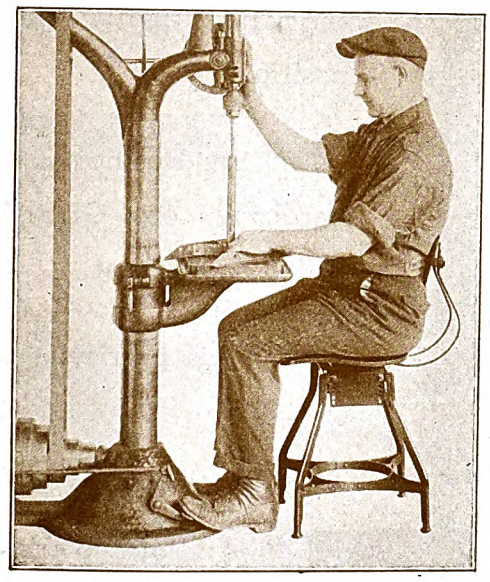
Because these rolls are light in weight they possess these specific virtues:

There is a saving in freight
They are easy to handle
Operating and power costs are reduced

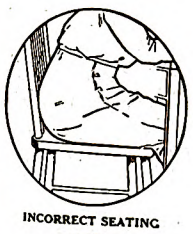
Built only on order to meet customers requirements. Submit your problem to us—send sketch or blue print and give dimensions required.

We are also manufacturers of short lengths of large sized seamless tubing to fit unusual conditions. The manufacturing experience of our several plants is at your disposal.

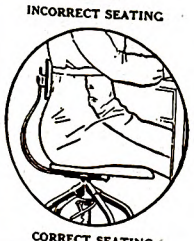
Wm. Wharton, Jr. & Co., Inc.
(Founded 1859)
30 Church Street, New York, U. S. A.
Cable address—Wilwharton



Increase Production with "PosturChairs"



INCORRECT SEATING



CORRECT SEATING

Employees' health and efforts depend to a great extent upon correct seating. They can't put forth their best in chairs that cause fatigue and muscular strain. Recognition of this fact on the part of executives has created a nation-wide demand for Uhl Steel "PosturChairs."

These new chairs of steel were scientifically designed to promote health and comfort and prevent fatigue—the thief of production. You sit in a "PosturChair"—not on it. The seat is shaped so that the body weight is properly distributed over the pelvic seat bones and thighs, and does not rest entirely on the pelvic bones as with other chairs. The low adjustable back forms a firm support for the spine just where support is needed. The body is held upright, comfortable. Vital body organs are allowed to function normally. The "PosturChair" keeps one feeling his best and working his best. The day is shortened; results are lengthened. It is the only steel factory and office chair which has the approval of the American Posture League, a national organization working for better employee health and efficiency.

Let us send you one for a trial in your factory, so you can test it under your own conditions, along side of any other chair made. If you don't think it means better work and more work, let us know and we will take it off your hands. Write today.

The Toledo Metal Furniture Co.
1616 Hastings St. Toledo, Ohio
Manufacturers of Uhl
Steel Furniture, Typewriter Desks, Chairs, Tables, Stands, Vault Trucks and Factory Equipment.



Glow-Brite

A Liquid Cleaner for Factory Glass

Cleans Factory Glass regardless of dirt, grime, carbon or rust, scale, without injury to paint, putty or sash.

Wet surface to be cleaned with GLOW-BRITE, then flush with water, no rubbing or scrubbing.

Leading Steel Mills, Foundries, Machine Shops, etc., use it everywhere.

5 Gallons easily cleans 4500 Sq. Ft.
6000 Sq. Ft. cleaned a day by unskilled labor.

It costs less per Square Foot to clean with GLOW-BRITE, because it costs less per Gallon.

GLOW-BRITE COMPANY

1006 Rockefeller Bldg.
Cleveland, Ohio

TRIAL OFFER

Clean 1800 Sq. Ft. at our expense before you buy it, and prove for yourself it is all we guarantee it.

Write us before you start your Fall Cleaning and state number Square Feet to clean.

Exclusive Manufacturers Liquid Factory Glass Cleaner.

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ELWELL-PARKER



HAND OR ELECTRIC TRUCKING?

Time has nearly passed for choosing.

ELWELL-PARKER

Electric Industrial Trucks and Tractors

are available now
but common labor is not

ELWELL-PARKERS

lift, carry, and place the loads where wanted.
They will deliver eight times the load at three times the speed of a hand trucker.
They are always ready, work early and late. Many operate 23 hours per day.

60% of all handling can be done by these units. May be driven practically any place a hand truck can be pushed.

Thousands in operation in over 200 branches of industry in 23 different countries. Tried and proven equal to every inside haulage requirement. Many have been in continuous service for over 10 years.

ELWELL-PARKER

trucks are guaranteed to save from the very start.

SELF-LOADING TRUCKS
DUMPING TRUCKS
CRANE TRUCKS
LIFT TRUCKS
TRACTORS

Our unobligating survey is yours on request, or ask for Bulletin 51.

ELWELL-PARKER
ELECTRIC COMPANY,
CLEVELAND



(Continued from page 40)

overloaded steam line and a steam-driven unit is installed. If Department "T" is an appreciable distance from the boiler house, the pressure drop and condensation losses make such an arrangement very inefficient. Considering also the greater economy possible from the large main units in the engine room, as compared with small, independent units scattered through the plant, motor drives are in many cases more economical than steam units.

Perhaps the most common use for exhaust steam in industrial power plants is for the heating of the feed water before it is introduced into the boilers. Here again clean heating surfaces are essential, requiring the installation of an oil separator in the exhaust line between the heater and the engine. Proper insulation reduces radiation loss and assures a more efficient transfer of the heat from the steam to the water passing through the heater. Recording feed water thermometers installed in the feed line between the heater and the boilers indicate the cleanliness of the heating surfaces and the efficiency of the heater.

The capacity of the heater is an important factor. There must be sufficient heating surface exposed to the hot steam so that the water will absorb the maximum amount of heat before it leaves the heater. When the heater is too small the exhaust steam passes through it without giving up its heat and the resultant loss in economy is considerable.

In the matter of attaining and maintaining steam power economy in industrial plants, the boiler house usually offers the largest field for immediate returns on the time and effort spent. Most of the coal is wasted there. It is not unreasonable to state that it is possible in almost any industrial plant to realize a saving of at least 10 per cent. of the power cost by effecting common-sense economies in the boiler house alone. In the average plant as high as 20, or even 25 per cent. are possible.

A Pillar of Strength

PERMANENT as the Corinthian pillars of old, are the files of those concerns that have wisely chosen Globe-Wernicke Steel Upright Filing Equipment. They are built by an organization with years of experience behind them, to give perfect service during the lifetime of any business.

Globe-Wernicke Steel Files are welded into a complete steel shell. The newly perfected slides work smoothly and noiselessly, and will not wear even when the drawer is filled to the maximum load.

The beautiful enameled finish adds that tone of refinement to any office which favorably impresses everyone.



All the hardware is solid brass and the perfect follower block, independent of rod, glides smoothly at all times and clamps the papers tightly in an upright position.

Big Business is now standardizing on Globe-Wernicke Filing Equipment.

This particular cabinet is No. 7141

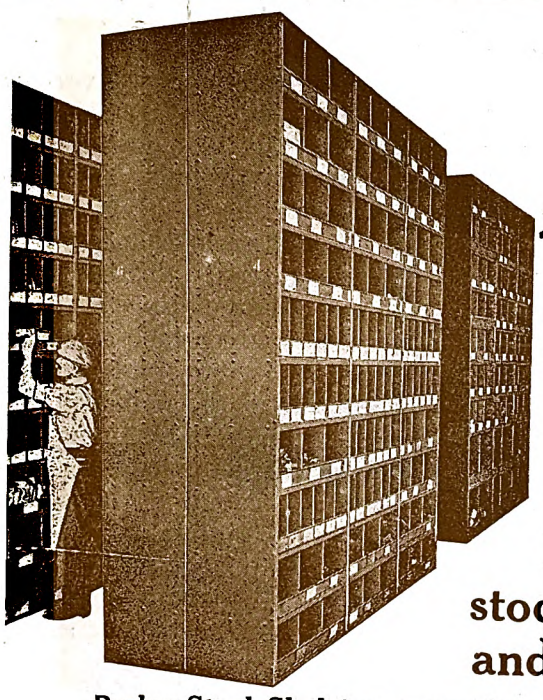
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The Globe-Wernicke Co.
Dept. I.I. 88
Cincinnati, O.

Globe-Wernicke
Steel Filing
Equipment

PRODUCTS

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BERLOY

Berloy Shelving systems are keeping stock of The Westinghouse Electric Co. in a systematic and economical manner.

Know what stock you have and where it is

Berloy Steel Shelving systems insure an accurate perpetual record of income, outgo and balance on hand. Stocks represent money. They should be systematically handled.

Berloy Shelving is quickly and easily adjustable to meet changing conditions. It can not wear out.

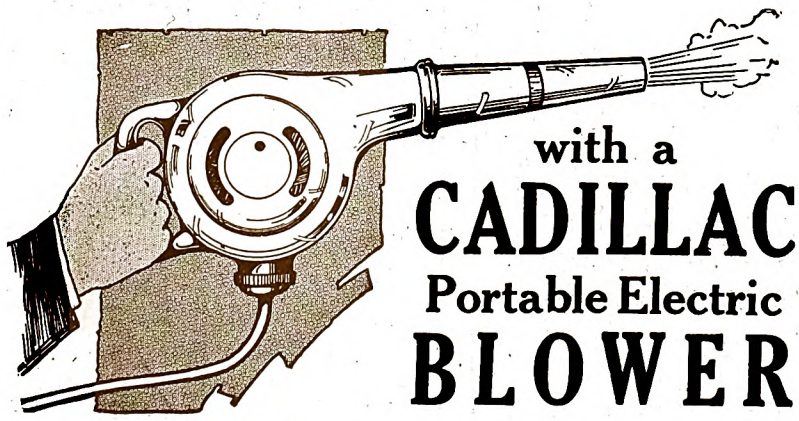
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THE BERGER MANUFACTURING CO CANTON, OHIO

Boston, St. Louis, Los Angeles, New York, Kansas City, Dallas, Philadelphia, Minneapolis, Roanoke, Chicago, San Francisco, Jacksonville

BERLOY STEEL SHELVING

BLOW OUT THE DUST



with a

CADILLAC Portable Electric BLOWER

Keeps Machinery Clean

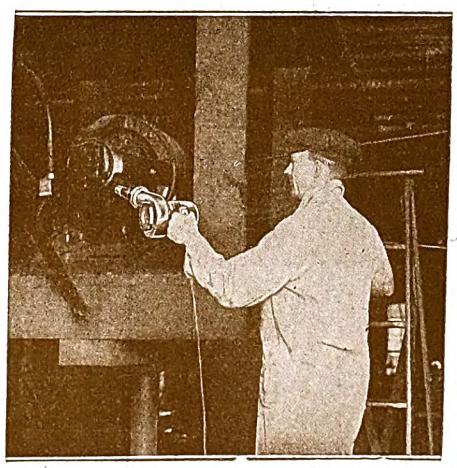
The handiest and most practical blower for blowing dust and dirt out of armatures, field coils, switchboards, machinery, line shafting, stock bins, shelves, etc. Complete in itself and requires no expensive installation or equipment.

Lowers fire risks. Makes more healthful working conditions. Reduces depreciation in electrical and other machinery.

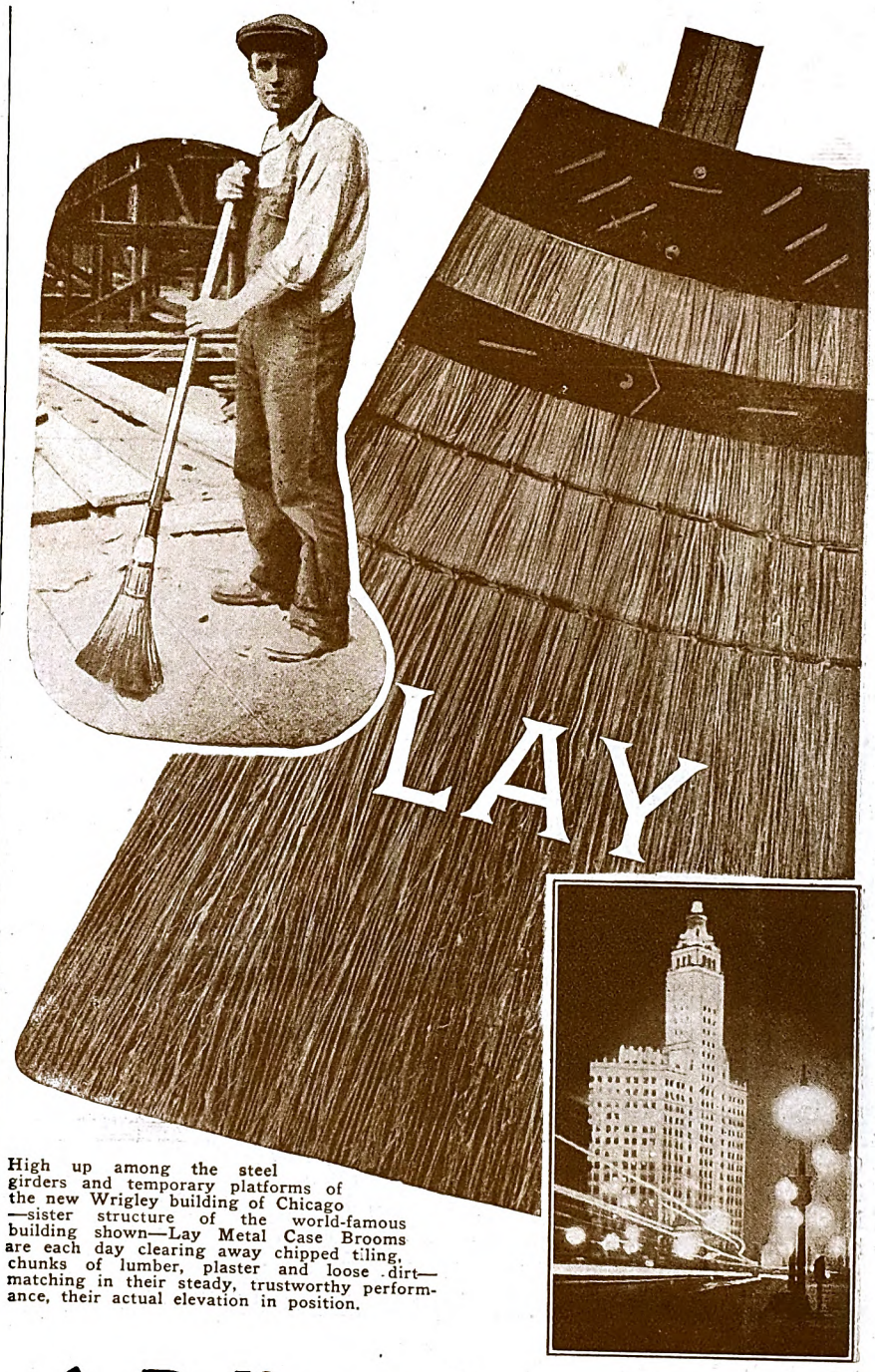
The CADILLAC BLOWER has proved its worth and is performing successfully with hundreds of uses in shoe factories, cotton mills, grain elevators, coal mines, engravers, printers, wood working plants, textile mills, box factories and every line of industry.

Write for descriptive folder giving prices and testimonials by leading manufacturers.

CLEMENTS MFG. CO.
Manufacturers of the
Cadillac Electric Vacuum Cleaner
612 Fulton Street CHICAGO
Canadian Factory: 76 Duchess St., Toronto



Cleaning small motors. No condensation to short circuit motor and no excessive pressure to injure windings or insulation.



High up among the steel girders and temporary platforms of the new Wrigley building of Chicago—sister structure of the world-famous building shown—Lay Metal Case Brooms are each day clearing away chipped tiling, chunks of lumber, plaster and loose dirt—matching in their steady, trustworthy performance, their actual elevation in position.

A Policy of Specialization

When Joseph Lay made brooms by hand back in the seventies he soon realized that the requirements of the different industries demanded different broom construction. He originated the policy of perfecting a special broom for each particular industry. He built a broom to do the job as it should be done—as *you* would have it done.

This policy and standard is still maintained by THE JOSEPH LAY COMPANY. No matter what your sweeping need is, nor what your line of manufacture, our forty-four years of experience has perfected a particular broom to serve you best and longest.

Try a dozen of our selection. Each one is fully guaranteed. What better assurance can we give of quality?

Satisfied Users of Lay Metal Case Brooms

American Car & Foundry Company
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Pennsylvania Railroad System
American Writing Paper Co.
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And more than 4000 other industrials.

Get LAY METAL CASE BROOMS for *your* particular job.

The Joseph Lay Company

120 College Street

Ridgeville, Indiana

Originators of the Metal Case Broom

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Developing the Full Capacities of the Factory Tractor

(*Continued from page 25*)

States, or from European or Asiatic countries. In fact, a number of concerns in the New York district have recently been employing a number of Orientals, and a raid on the manufacturing plants in Brooklyn, netted quite a round-up of Chinese labor that had been smuggled into the country.

Why do our business men go to such extremes in abetting in the flouting of the laws of the land, when they can, by simply investigating, find means of applying mechanical equipment to their common labor problems.

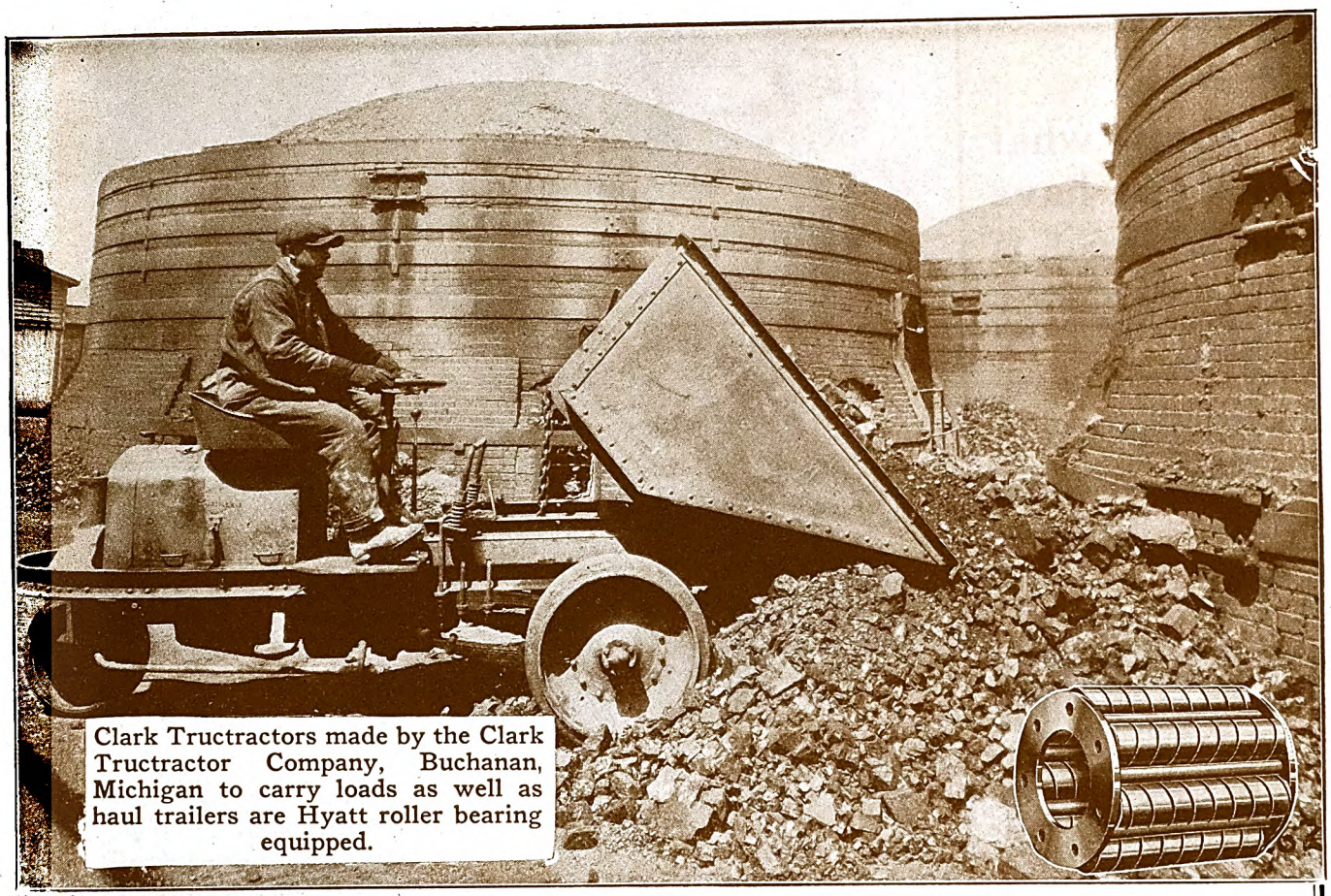
While tractors and trailers are dealt with in this particular article, other articles appearing in this publication have shown how to use various types of conveyors and elevators, in case the material to be handled is in bulk, and also conveyors have been shown for handling package goods. The American industrial tractor of either electric or gasoline drive, given the proper application, is the greatest labor conserver in the industrial vehicle family. Assuming 10 tons as a tractor load, a single machine replaces 40 hand truckers, handling 500 pounds each. By proper routing with a drop and pick-up system, of trailer trains, a tractor can be kept almost constantly in action under load.

The shrewd executive, seeking economic or cheap labor, can adopt no better tactics than to work out a way to apply tractors and trailers to his material handling problems. Haulage is the backbone of virtually every industry. Unless raw materials, parts, finished products, supplies and freight move smoothly, and on time to the point of need, the whole operating schedule breaks down with an expensive waste due to labor time, idle equipment, and all the far-reaching effects resulting from an upset of routine. The man on the hand or push truck, and the gang carrying a load by hand, whether in industrial plant, storage yard, warehouse, freight platform, passenger terminal or pier shed, are heavy penalties on profits. Power does the job more cheaply.

In spite of this truth, there are still thousands of individual companies whose executives extravagantly employ man power for the internal handling of incoming and outgoing freight, raw materials, parts and finished products. In addition to wasting needed man power, these companies, almost without exception, are showing too high operating costs, and too narrow profit margins.

Most of the advantages obtained by the use of a tractor trailer system of industrial transportation, when compared to manual handling, are:

1. Reduced number of men on the payroll. Cheap operating costs.



Clark Tructractors made by the Clark Tructractor Company, Buchanan, Michigan to carry loads as well as haul trailers are Hyatt roller bearing equipped.

Bumping—Banging—Jolting Along

Over cobble stones, up curbs and down, across rough lots, quickly and dependably carrying their loads-all in the day's work for Hyatt equipped Clark Tructractors.

An important factor in the capable handling of loads under severest conditions is the stamina of Hyatt roller bearings. Day in and day out they produce their easy rolling motion and with no attention except lubrication three or four times a year will last throughout the life of a tractor, without adjustment or replacement.

And in trailers Hyatt bearings are just as valuable—they enable tractors to pull twice as many trailers without battery strains or noon-day boosting.

For dependable and economical haulage equipment specify that your tractors and trailers be Hyatt equipped.

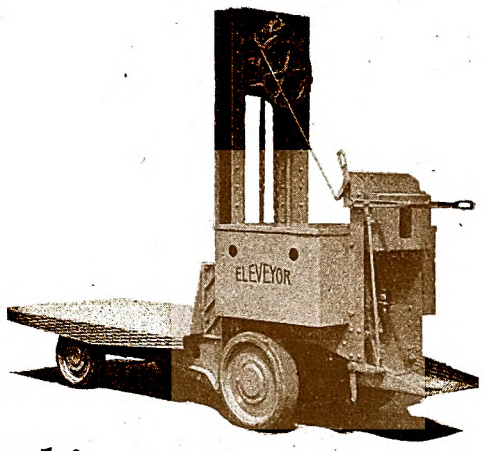
Hyatt Roller Bearing Co.

Newark Detroit Chicago San Francisco

Worcester Milwaukee Huntington Minneapolis Philadelphia
Cleveland Pittsburgh Buffalo Indianapolis

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Combines the Functions of 3 Trucks in 1



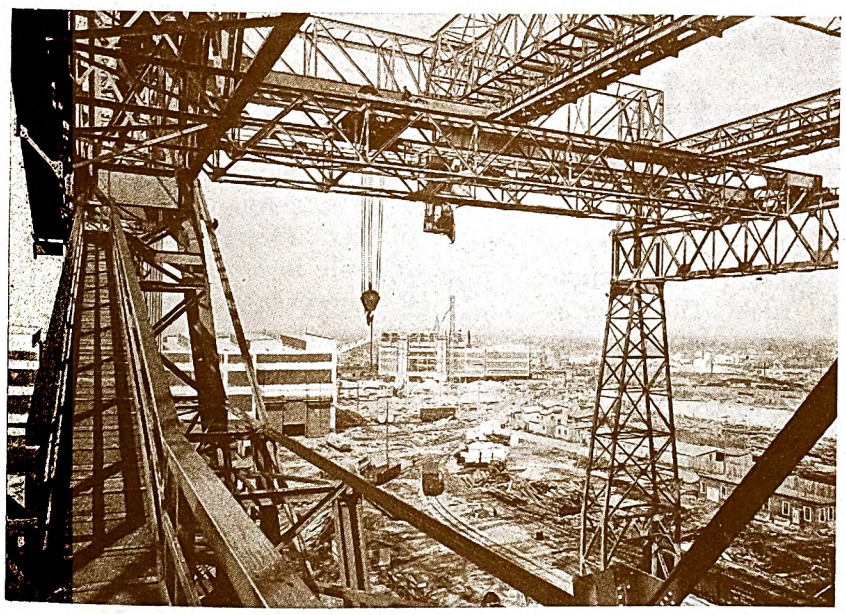
Write for this TO-DAY

The ELEVEYOR combines the advantages of three different trucks in one. It is a low platform type; likewise, a low elevating type for conveying loading platforms; also a high elevating type for stacking. Get our new catalog.

ELEVEYOR INDUSTRIAL TRUCK CORP.

56 Huntington Street Brooklyn, N. Y.

NILES CRANES



Save time—Save labor—Save space with modern crane equipment

The shipyard owner often finds it convenient to build a runway structure that will carry several cranes of different spanes and capacities. Such an installation is shown here. The service demanded is severe. Never sheltered from the elements, such cranes are frequently on duly twenty-four hours a day.

Niles Cranes are the logical choice for such service because of their rugged reliability. They can be furnished in capacities to handle a winch or the main engines with equal ease as occasion may require. We build them up to 250 tons.

Tell us your crane needs.

For the Steel Mill Rolling Mill, Foundry, Shipyard, Quarry, Mine Yard, Locomotive Shop, Forge Shop, Central Station and wherever heavy materials must be handled with speed, safety and economy.

NILES-BEMENT-POND CO.

111 BROADWAY—NEW YORK CITY

CRANE WORKS— PHILADELPHIA, PA.

No. 5 *of a series illustrating the many industries served by Niles Cranes.*

3. Quicker and better deliveries of materials between operations.
4. Complete co-operation between departments.
5. Increased production.
6. Reduction of labor troubles.
7. Reduction of labor turnover.
8. Reduction in amount of materials and parts damaged in transfer from operation to operation.
9. Better working conditions.
10. There are numerous others, such as assisting in distributing all costs of handling between departments, instead of placing it as an overhead item, providing a means of checking up the weak spots in the organization, etc.

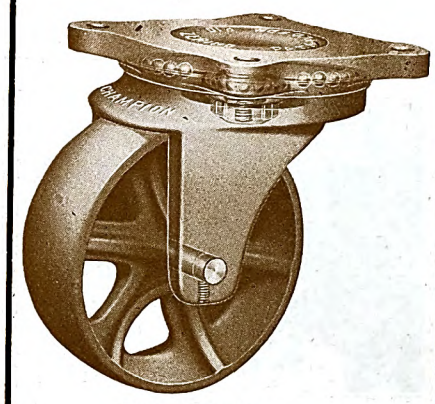
The number of advantages depends upon the amount of attention paid to the system, and the human element which operates it. By this I mean, that if the system is operated with a common laborer as its directing head, the results will not be as gratifying as if an intelligent and able man were placed in charge.

The writer has often analyzed the transportation problems of plants, with a view to improving the present handling of materials, and often it has been recommended that a tractor trailer system be installed. If no equipment but common stevedore hand trucks are being used in the plant, it frequently necessitates the purchase of considerable new equipment. Many times the recommendation has been turned down because the executive did not know what it was costing him to handle materials with his present equipment, and he did not take sufficient interest in it to have his own force find out the cost, or permit an outsider to determine it for him. In other instances, the present costs have been determined, but the initial investment has appeared too large, and the difficulty of obtaining such a large appropriation has deferred the installation of the system. It is now my practice, and I strongly recommend this method of procedure to salesmen and executives, to take

The New **ZERING CHAMPION**

Double Race Ball Bearing CASTER

A real Achievement in Caster Construction



Patent Pending

Adjustable without being removed—All parts interchangeable

It is FRICTIONLESS
LONG WEARING
FREE SWIVELING
A GREAT TIME & MONEY SAVER

In the Champion Adjustable Double Race Caster, both races are in contact; there is no friction on stem, insuring equal distribution of weight and wear; the friction and strain are relieved from all directions; it is not affected by side thrusts.

Champion Casters pay for themselves in time saved because of the adjustment.

When ball races become worn, it is only necessary to adjust the nut in center of fork; you need not pull truck apart or buy new casters. Every adjustment of the Champion is the equivalent of a new Caster.

The wheel shaft assembly is also an advanced step.

There are no projecting bolt heads, nuts or cotter pins.

Made in all sizes.

Send today for Caster bulletin and learn why

Champion Adjustable Casters are a real investment.

Just detach coupon and mail.

The H. Zering Mfg. Co.,
4425 Enyart Street,
Oakley Sta.,
Cincinnati, Ohio

The H. Zering Mfg. Co.
Oakley Station, Cincinnati, Ohio

Please send Caster Bulletin telling about the new Champion Double Race Casters.

Firm name .....

Address .....

Attention of .....

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one step of the problem at a time, and segregate it, so that after its successful solution, it will be possible to take the next step without having to alter the first. This method necessitates making a complete study of the problem, and laying down a definite program, but gradual development will always prove the soundness of the complete system.

The installation at the Minneapolis Steel and Machinery Co., at Minneapolis, Minn., shown in figure 20, was installed in this manner. It was found that the old method of horse and wagon intra-plant transportation, the cost of handling materials was $1.50 per ton, and it required 47 men, plus 14 teams and wagons to perform the operation, which was none too good. In 1917, the company investigated, and started to install a tractor trailer system of transportation. In 1919, the installation had been completed, and it was found that 14 men, 3 storage battery tractors, 53 small trailers, four 4-ton trailers, and 2 2½-ton capacity trailers, a motor ruck, popularly known as "jitney" and power lift transfer trucks which handle materials in the shop, could handle all the company's materials. The cost had been reduced to 30¢ per ton, and from 50 to 100 per cent. more tonnage was handled by the new equipment. This saving of $1.20 per ton handled, makes an aggregate saving of $200 per day in handling costs alone. It did not take many days' operation to pay for the installation.

There are few industries to which the tractor trailer system cannot be applied. Figure 6 shows a gasoline tractor operating in the plant of one of the largest metal works in the country, and this installation of material handling equipment has been found very successful. Figure 11 shows an electric tractor handling refuse in the narrow aisles of stock yards. This has always been a very serious problem, because large vehicles could not negotiate the short turns. Note how the trailer train is making an "S" curve. The tractor can just be seen in the center of the picture. There are at least 12, if not more, trailers in the train. This installation has made large money savings.

Figure 13 shows another long train of trailers being handled in the cooperage plant of a large oil company. While the type of runway shown is not highly recommended, the tractor trailer train will operate over it, but the maintenance costs will be slightly higher than if concrete runways were installed. Of course in this case, where the face of the pile is continually shifting, it is necessary to move the runway with it.

The secret of economical operation is heavy loads. Figure 12 shows an electric tractor handling approximately 6 tons of material on four trailers. For this reason, considerable attention should be paid to the trailing equipment, so as to get the most efficient operation. Figure 5 shows an excellent example of the trackability of four-wheel steer trailers When this type of trailer is used, the trailer will follow wherever the tractor can get through, no matter how long the line may be.

Long trains of trailers, heavily loaded and operating over asphalt and concrete roadways, save enormous sums in intra-

(Continued on page 49)



This Mathews System saves its cost every three months

Thats the enormous saving over hand trucking methods that their Mathews Gravity Conveyor System is making for The Better Tires Company, Chicago. In their packing and shipping rooms, it handles an average of 1000 orders a day so quickly that this firm can guarantee six-hour service on every order. Not only that, but it also means many feet of valuable floor space saved.

A glance at the photograph above will show the great variety of packages which ride on this conveyor. Mathews rollers turn so smoothly that they will easily carry small, light packages. Yet they are so strongly built that heavy loads don't wear them out.

In spite of constant use, day in and day out, for over two years this system hasn't cost a penny for repairs. That's the kind of service that is *built into* Mathews Conveyors.

Every Mathews System is planned by our engineers to meet the user's specific needs. The saving which such a System could make in your plant might not be as large as in this case, or it may be even more. But you can figure a substantial saving over other handling methods by free gravity for power plus Mathews dependability in equipment.

Dictate a letter today for the Mathews catalog showing the great range of uses of both permanent and portable units.

Mathews Gravity Carrier Co.
161 Tenth St., Ellwood City, Pa.
Branch Factories:
PORT HOPE, ONT. LONDON, ENGLAND

MATHEWS
SPEED ECONOMY
GRAVITY ROLLER CONVEYER

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Stuebing Lift Trucks—*263 of them*—help Goodyear build tires quicker and cheaper

You are right! The Goodyear Tire & Rubber Company would not standardize on Stuebings—and buy 263 of them, to date—if any other make of lift truck would serve better, or longer, or more economically.

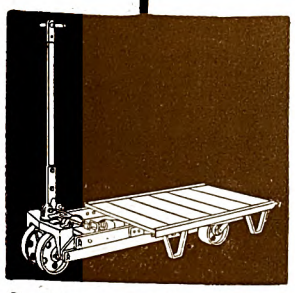
But Goodyear knows Stuebings! Since they bought their first Stuebing truck on June 11th, 1916, the labor and time saved by Stuebings in the manufacture of Goodyear tires has totaled thousands and thousands of dollars.

With Stuebing Lift Trucks your material handling can be done at a saving of up to 80%, for one man with a Stuebing does the work of five men with ordinary four-wheel trucks.

And these savings are actual, permanent savings, remarkably free from deductions for upkeep and repairs.

Of all steel construction—even to the wheels—with a frame as sturdy as the steel shell of a sky-scraper, Stuebings have in them a reserve force of strength that cannot be mastered by the wear and tear of constant use. *They are built for hard work—and they get it!*

Let us point the way to material handling savings in your plant. A Stuebing representative, in your vicinity, will be glad to discuss your specific needs. Write us today.



Stuebing Steel-Bound Platforms match the Stuebing Lift Truck in strength of build and adaptability of service. They won't wear down or wabble

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The Stuebing Truck Company

Cincinnati, Ohio **Montreal, Quebec**

StueBing

LIFT TRUCK SYSTEMS

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Save $300



—each month on operating costs

That is what Northwest owners are capable of doing with their Northwest cranes

Daily Operating Costs

Item	Northwest Gas Crane	Standard Steam Crane	Northwest Saving Per Day
1 Union Engineer	$	$	Same
1 Helper (if required).....	$	$	Same
Oil, Grease and Waste.....	$	$	Same
Gasoline (25 gal. at 20c)...	5.00	6.00	1.00
Coal (¾ T at $8.00).....			
Team for carrying coal and water (½ day at $8.00)...	NONE	4.00	4.00
1 Fireman	NONE	5.00	5.00
Overtime for firing up in morning and pulling fires.	NONE	2.00	2.00
		Daily Saving	$ 12.00
MINIMUM MONTHLY SAVING (25 days).....			300.00

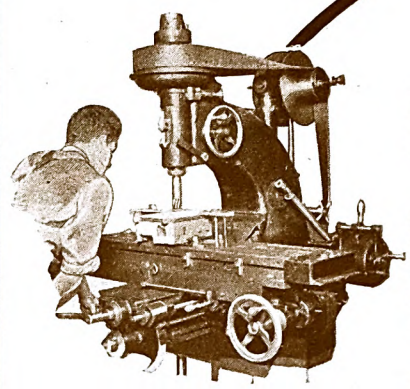
Northwest Engineering Co.

1231 Steger Bldg., Chicago, Ill.

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GAS or CRANES · SHOVELS · DRAGLINES ELECTRIC

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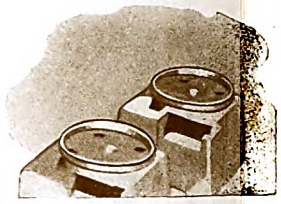
It Can't Be Beaten for Fine Milling Operations

When milling intricate machine parts, dies, or any pieces requiring the very highest type of milling precision and finish—those who know from experience recommend the Becker Vertical Milling machine.

At the Johnson Fare Box Co., Chicago, they get "that exceedingly fine smooth finish" on parts for coin counting machines by milling them on Becker Vertical Millers.

You will be greatly rewarded for investigating Becker Millers for your milling operations

They are built in many sizes.
What are your milling problems?
Write us about them.

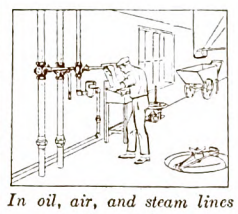


REED-PRENTICE CO.

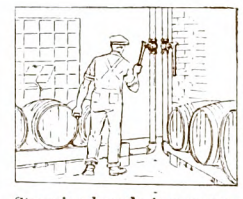
LATHES-RADIAL DRILLS
BECKER MILLING MACHINES
MILLING CUTTERS

RAPID PRODUCTION LATHES
WHITCOMB PLANERS
SPECIAL MACHINERY

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677 CAMBRIDGE ST.,
Branch Offices and Agents Throughout the World



In oil, air, and steam lines in the gas plant.



Steaming barrels in cooperage plants.

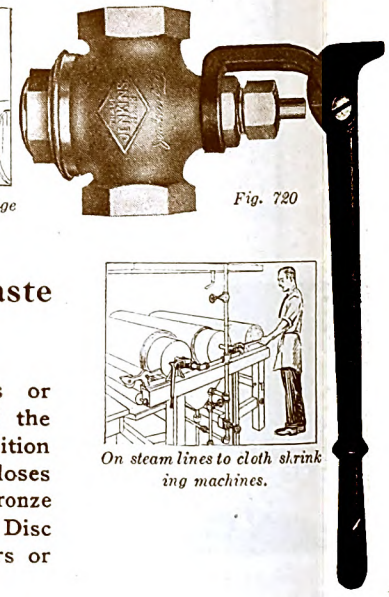


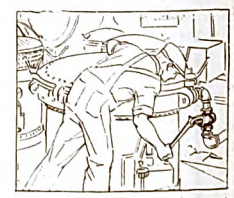
Fig. 720

Saving Time, preventing Waste in many Industries

Jenkins Rapid Action Valve opens or closes automatically with a pull of the lever. The lever stays in either position without being held, and the valve closes *without water hammer*. Made of bronze and fitted with Jenkins Renewable Disc for air, steam, water, or other vapors or liquids.

It is illustrated here in a few of the many industries which have adopted it because its rapid on-and-off action saves time and prevents waste. A valuable valve for many purposes, built in every respect up to Jenkins high standards.

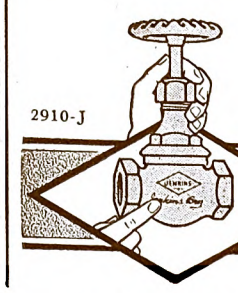
On steam lines to cloth shrinking machines.



On steam and water lines to cooking vats.

JENKINS BROS.

New York
Montreal
Philadelphia
Chicago
Boston
London



Always marked with the "Diamond"

Jenkins Valves

SINCE 1864

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(*Continued from page 46*)

plant haulage. Examples of these heavily loaded long trains, using different types of trailers, are shown in figures 8, 15 and 16.

While concrete roadways wear out somewhat quicker than asphalt under tractor trailer traffic, the reduced frictional losses offset the additional maintenance expense. Figure 16 shows a tractor making delivery of 6 trailers, loaded with approximately 15,000 pounds of material. Before delivery is completed, the tractor passes through four swinging doors, the only labor required being the tractor driver.

Special trailers for handling cumbersome materials are accessories that help to keep the tractor busy, and reduce handdling expenses. Thus special trailers are usually developments by particular industries, or devices perfected by material handling equipment manufacturers for particular industries. Figure 17 shows special trailers for handling locomotive wheel tires.

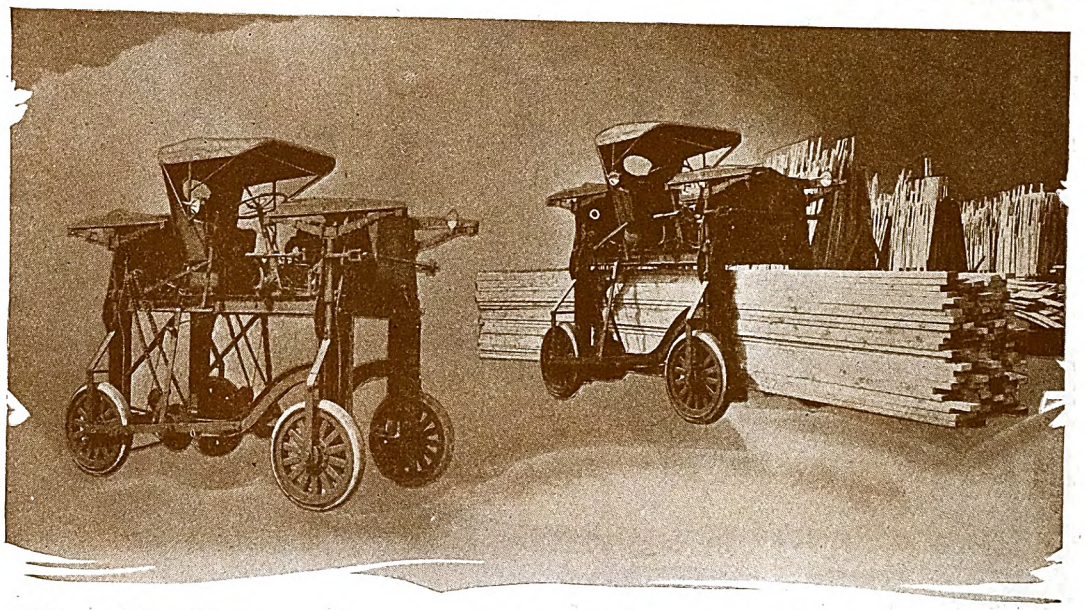
Handling merchandise at freight terminals, both steamship and railroad, is one of the many places where tractor trailer trains are reducing handling expenses, and speeding up the handling of materials. Figure 19 shows a train of trailers operating on a transfer platform at a railroad terminal, while figure 10 shows a tractor trailer train entering one of the large steamship piers off West Street in New York City. There is a point to be noted in figure 10, namely that caster trailers are not recommended to be hauled any great distances over rough cobblestone pavements, as shown in this installation, because the small wheels break under the severe strain, particularly when heavy loads are carried, and it is therefore suggested that a portion of the runway entering upon pier sheds should be covered with asphalt so as to provide smooth runways for the tractor trailer trains, and still provide rough footholds for the horses that have to pull the heavy truck loads on to the pier.

Figure 14 shows a good type of trailer chassis to be used in connection with pier work. The superstructure or hopper body is particularly designed to meet the requirements of this installation, where the tractor is used for coaling the Staten Island ferries which ply between Port Richmond and New York City. The large trailer wheels are better adapted for rough runways.

Figure 21 shows an end dump trailer. These dump bodies are in the form of an attachment which is fastened to a standard four-wheel steer trailer. In case the dump bodies are not required, they can easily be detached, and the trailers can be used for handling case goods.

It is not only in the handling of trailers that tractors can be used, but they can also be fitted into installations for hauling cars where tracks are already installed. The installation shown in figure 18 is at the receiving station of the Chicago Tunnel Company. This organization is the only enterprise of its kind in the world. They operate a 70-mile tunnel system under a congested district of the city of Chicago.

SKF



Ball Bearings Defeat Friction's Destructive Effects and Reduce Power Waste

THE greatest single factor which must be combated in obtaining high operating efficiency in haulage units is friction in the bearings supporting the vital rotating parts. Friction means not only power waste but also wear of both bearings and gear teeth. Necessity for bearing adjustments and replacements is evidence of wear but no amount of adjustment can restore gears to their original high operating efficiency.

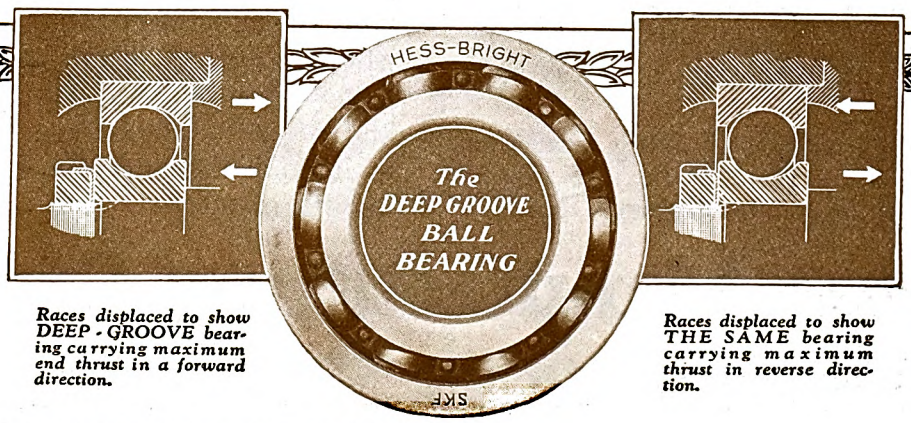
On this gasoline lumber carrier deep-groove ball bearings made by the Hess-Bright Manufacturing Company reduce power losses and maintenance to a minimum and help to keep the truck ready for service by eliminating the need for bearing adjustments and replacements. So little wear occurs that it is not noticeable after years of service.

Ball bearings on cars and trucks and on industrial and commercial machinery are an assurance to the user that precautions have been taken to insure continuity of service, high operating efficiency, maintained accuracy and economy of performance.

THE HESS-BRIGHT MANUFACTURING COMPANY

Supervised by SKF INDUSTRIES, INC., 165 Broadway, New York City

1001



Races displaced to show DEEP-GROOVE bearing carrying maximum end thrust in a forward direction.

Races displaced to show THE SAME bearing carrying maximum thrust in reverse direction.

BALL BEARINGS

The Highest Expression of the Bearing Principle

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This subway system is used exclusively for handling baggage, freight, coal, ashes and building excavation material, and facilitates the movement of millions of tons of materials handled in the district bounded on the North by Chicago Avenue, on the South by 16th St., on the East by Lake Michigan, and on the West by Greene Street, and serving in a measure to relieve the street congestion of this already overcrowded district. The average tunnel level is about 40 feet below the street grade. The tunnel company operates their own freight receiving stations at the various points along the system, and it is at these various receiving stations electric industrial tractors.

While tractors are used in that they are making use of trains in the hauling of materials, they can also be used for movement of heavy machinery when setting it in position in new plants. Figure 22 shows a tractor operating in this capacity.

While care should be taken in selecting the right type of trailers, considerable attention should also be paid to the locomotive or tractor. It is evident that this is an important unit, and a tractor should be capable of developing sufficient "tractive effort" and "draw-bar pull" to haul a load and travel at the required speed. This is generally a matter of battery capacity in the case of electric tractors and the selection of the proper size motor or engine when using gasoline tractors.

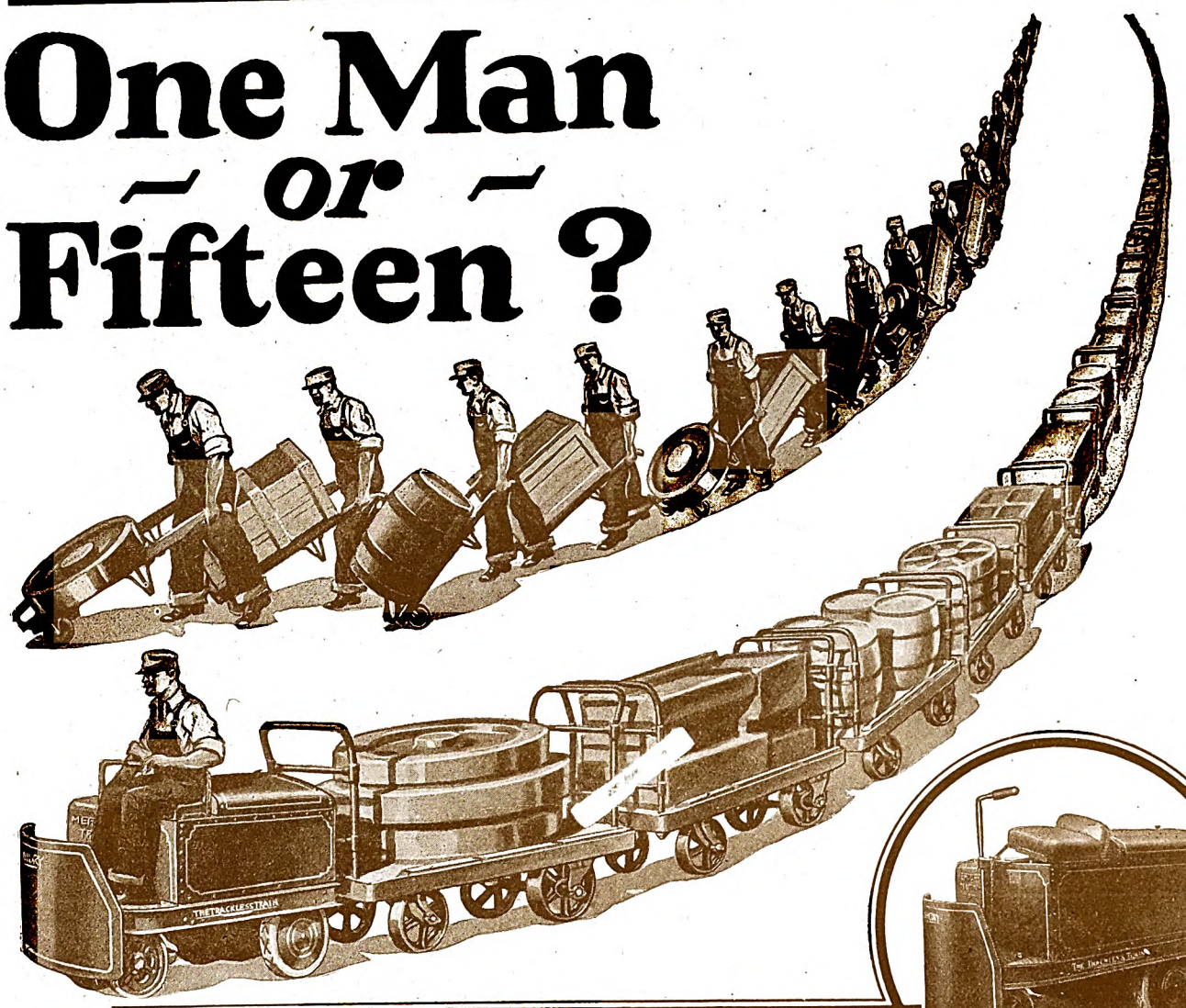
The term "tractive effort" is used to designate the force in pounds which is exerted at the tires of the tractor. The term "draw-bar pull" is employed to signify the effort in pounds at the coupling between the tractor and trailers. A tractor performs in accordance with known physical laws, mechanical and electrical. When certain elements of a material movement problem are known, the work which can be expected from a tractor can be calculated to a certainty. These elements are:

(a) Weight of the train to be hauled.
(b) Character of the surface over which the train must run.
(c) Grades which will be encountered.
(d) Speed at which the train must travel in order to move a given amount of material in a given time.

The weight of the train to be hauled and the character of the surface, determine the "tractive effort" necessary. The grades which must be overcome determine the maximum demand on the tractor. The speed necessary to move a given quantity of material in a given time determines the size and capacity of the battery, and the size of the motor or gasoline engine.

The simplest way to solve this problem is to submit it to one of the standard tractor manufacturers, as they have already figured out the capacity of their equipment under the term "draw-bar pull" and their catalogues list the capacity in pounds, both normal and maximum, and they can quickly recommend after reviewing all conditions, the best type of tractor to be used. The power or tractive effort of any tractor depends directly upon the

One Man — or — Fifteen ?



The Trackless Train

THE hand truck method requires one man to propel each truck. The Mercury method enables all but one man in a gang like this to be put on productive work.

While the Mercury tractor does the work of many men, it operates at the cost of one. Interest, depreciation, electricity, oil, grease and repairs—all amount to no more than the day wage of an average laborer.

This labor and money saving system of industrial hauling is so flexible that it meets most any requirements. Narrow aisles or crowded floor space do not prevent these little tractors from winding in and out with their heavy trains. Special trailer designs handle material of unusual shape or weight. The tractors are of ample power for steep grades, and their construction is so rugged as to stand both use and abuse.

May we tell you what others are doing under conditions similar to yours? We know it will interest you. It may lead to important changes in your system of hauling material.

Mercury Manufacturing Company

4118 S. Halsted Street. **Chicago.**

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weight of the drive wheels and the ability of the motor to turn them under that weight. Tractor trailer trains can draw a heavier tonnage than a load-carrying truck of equal battery capacity. The majority of standard tractors have sufficient "tractive effort" to haul train loads of 7,000 to 20,000 pounds, maintaining a speed of three to four miles an hour in the case of electric, but a slightly higher speed in the case of gasoline tractors.

Practically all of the standard tractors now being manufactured have eliminated the faulty designs which were prevalent in the first few installations, and as to whether a tractor should be of three-wheel four-wheel or center control type as shown in figures 18, 14 and 7, is purely a matter of personal preference. Frequently if more than one manufacturer is consulted, one will possibly recommend the use of a three-wheel tractor, while another will recommend the use of a four-wheel tractor. This is a small matter, and the manufacturer will generally stand back of his recommendation.

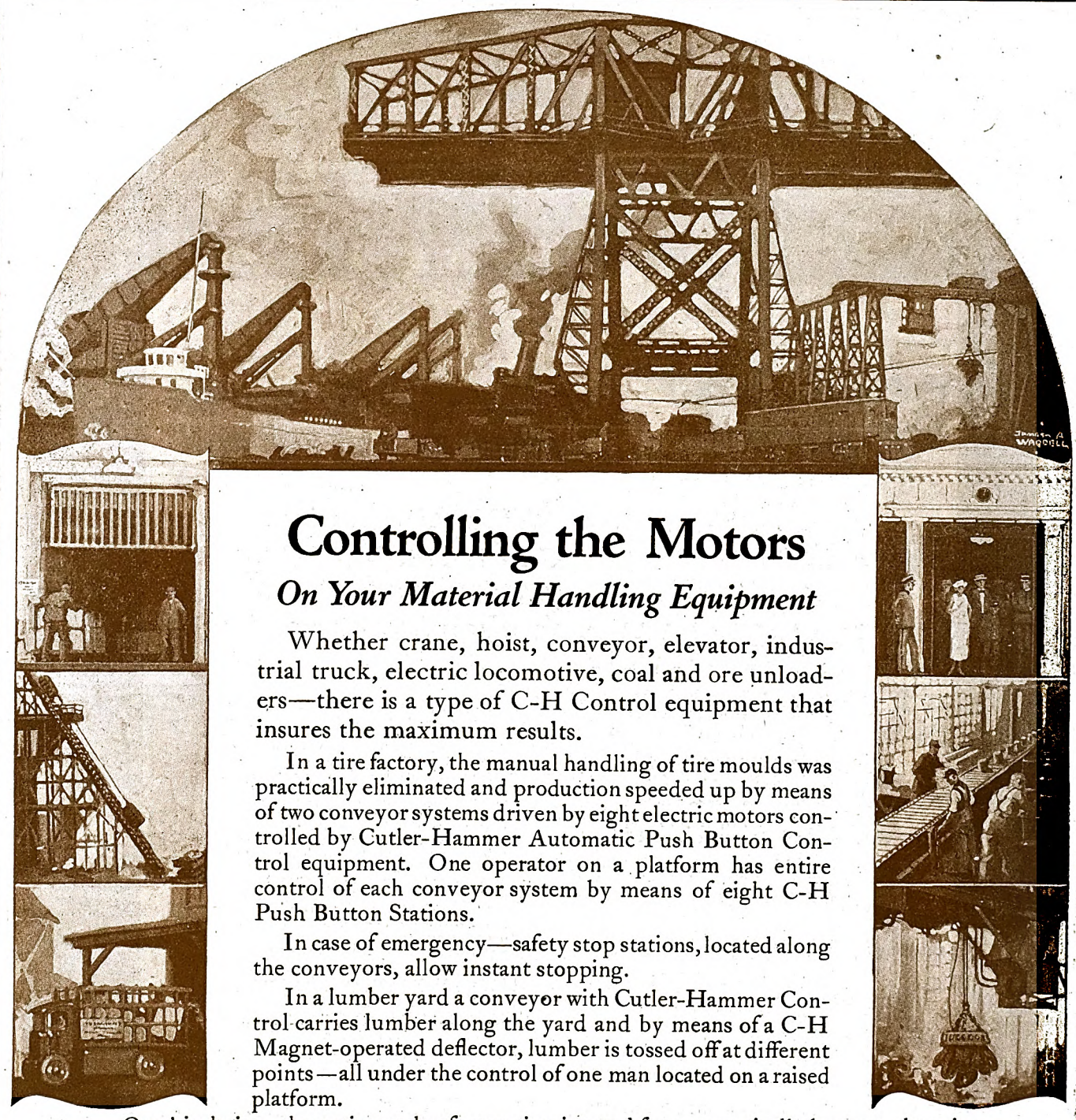
There is, however, a tendency for each manufacturer to feel that his equipment can perform all classes of work, and this is particularly true where the competition narrows down to whether a gasoline or electric tractor should be used. It is difficult to make a general statement recommending which type to employ. It can, however, definitely be stated that gasoline tractors with large wheels are more adapted to rough yard work than standard storage battery electric tractors. By rough yard work, we mean as illustrated in figure 9.

The large wheels which are on the majority of gasoline tractors, make for better operation over bumpy ground, and the use of gasoline in these instances is better, because with an electric tractor, the continual pull soon discharges the battery, and occasions the change of battery, or the boosting of batteries during the noon hour, and frequently if the work is heavy, the tractor will lag toward the end of the day.

On outside work, over rough ground, where gasoline tractors are used, the trailers should be equipped with large wheels as shown in figure 9. If small wheels are used, there is frequent breakage and rough riding for the materials.

In a number of industries where tractor trailer systems of transportation have been installed, it has been found economical to make a number of building changes, which frequently involves considerable outlay of money. For instance, a plant which manufactures automobile tires, found it advantageous to install a subway system of tunnels to take care of their tractor trains, and their industrial trucks. The use of tunnels under shops is becoming general practice. Tunnels not only eliminate traffic on the operating floor, but if properly laid out, they can be used as a point of storage, thus reducing the amount of materials standing on the manufacturing floors.

Other companies have found it advisable to build bridges between buildings, especially where materials are used on the same floor levels. By building bridges, the lowering and elevating of materials is



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On Your Material Handling Equipment

Whether crane, hoist, conveyor, elevator, industrial truck, electric locomotive, coal and ore unloaders—there is a type of C-H Control equipment that insures the maximum results.

In a tire factory, the manual handling of tire moulds was practically eliminated and production speeded up by means of two conveyor systems driven by eight electric motors controlled by Cutler-Hammer Automatic Push Button Control equipment. One operator on a platform has entire control of each conveyor system by means of eight C-H Push Button Stations.

In case of emergency—safety stop stations, located along the conveyors, allow instant stopping.

In a lumber yard a conveyor with Cutler-Hammer Control carries lumber along the yard and by means of a C-H Magnet-operated deflector, lumber is tossed off at different points—all under the control of one man located on a raised platform.

On skip hoists, the entire cycle of operation is cared for automatically by control equipment designed by Cutler-Hammer engineers. In fact, since electric motors were first used commercially C-H engineers have worked with motor manufacturers, equipment builders and industrial heads to increase the adaptability of motor-driven equipment.

This accumulated experience and data are available to solve your problem—C-H engineers in the various district offices are ready to consult with you.

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reduced to a minimum, and invariably the bridges pay for themselves by the reduced operating expenses.

While considerable has been said regarding the best type of tractor and trailer to be used, there is still a more important item, namely; the men who operate the system. It must be remembered that production depends on getting the materials from one point to another on schedule time, and for this reason a fairly intelligent workman should be selected as a tractor driver. The dispatchers and superintendent of transportation should be men of ability. Where a driver is intelligent, and can be interested in his job, he will facilitate the movement of materials to a great extent, and will readily meet the small difficulties which must constantly arise in any such job, and can overcome them without having to delay proceedings for minor instructions.

At one time it was the practice to have a tractor driver and a helper for each train, but experience has shown that far better results are obtained by eliminating the helper. The trains can be made ready, so that the driver does not need a helper. By using only one man (the driver) it is found that there is less loitering, horse play, etc., and less time is actually spent in preparing the train and getting it under way.

Care should be taken that all safety measures are provided, and while it is essential that the tractor train, to make the best possible speed should have the right-of-way over hand trucks, etc., the drivers should be cautioned and necessary signs and instructions should be posted at intervals, so that they will sound a warning for pedestrians. All workmen should be instructed that they are never to ride on the trailer train, as this is the source of the majority of accidents occurring where tractor-trailers are in operation.

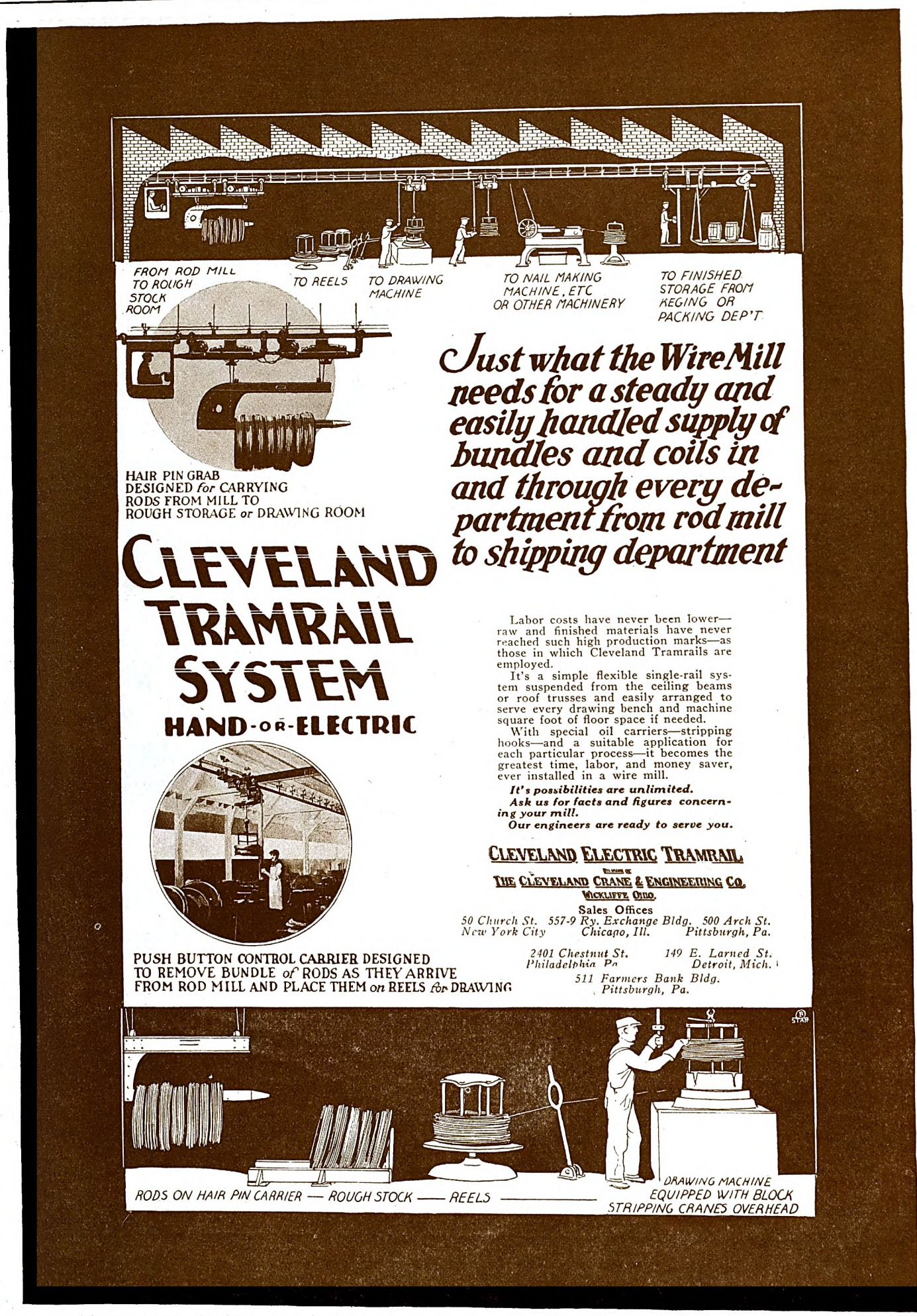
Each industry employing the tractor-trailer system of transportation, has its own peculiar adaptation of the system, but most all successful operations follow the principles of railway operation.

To-day, progressive executives and boards of directors, in designing new industrial buildings, warehouses and terminal structures, are beginning to realize the great importance of the proper allowance for internal transportation.

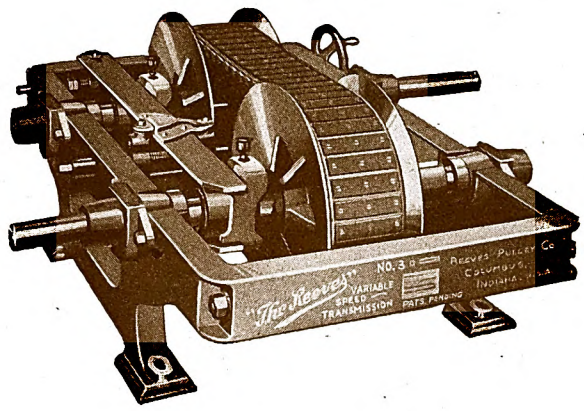
The Studebacker Automobile factory at South Bend, Ind., stands out prominently in this respect. The engineers here designed the structure about the proposed transportation system. The reason for this procedure was the collection of itemized costs data showing the large proportion of costs which is incurred in moving material from the receiving platform through the operations to the shipping platform. One piece of material may easily move a distance of 5,000 feet about the factory, from the time it is received as raw material until it is shipped, and hundreds of tons of material per month are handled through a single moderately sized factory.

Another such case is the plant of the Youngstown Pressed Steel Company, where, owing to the large volume of

(Continued on page 54)



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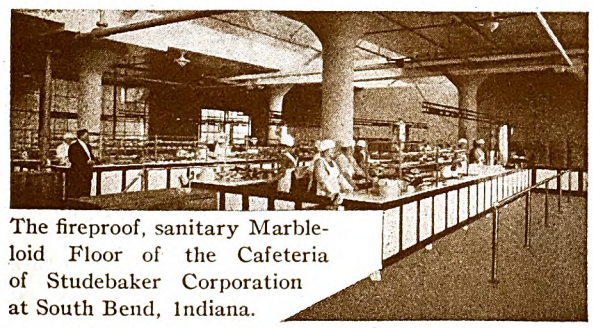


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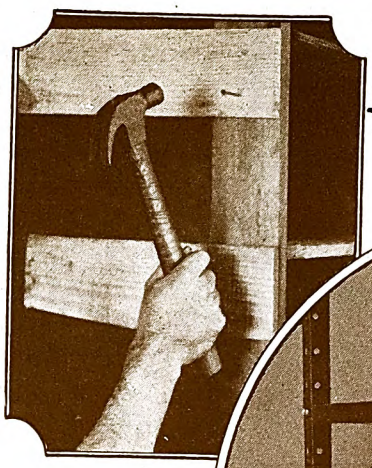
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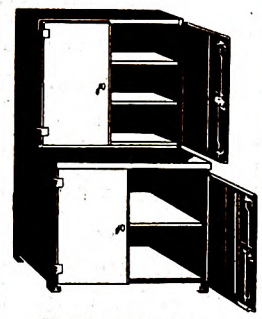
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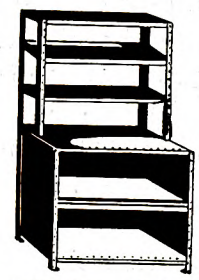
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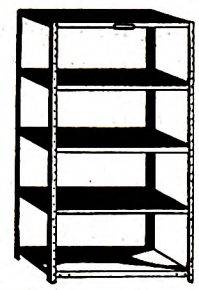
From standard parts that are carried in stock in various sizes, any form of shelving may be constructed — skeleton type, or with sides, backs and doors; optional reinforcing for heavy loads; in styles for factory use or, with attractive cover strips, for the finest office; in solid banks, or run beneath or over windows, stairways and the like.



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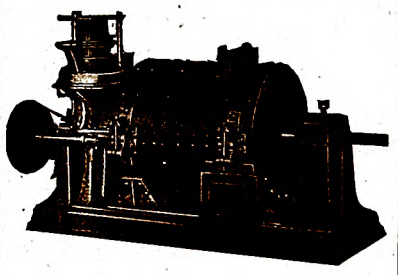


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The Aero Unit System

of Pulverized Coal again demonstrates, as in other work of human endeavor, how an original idea at first worked out by complicated and costly methods is finally simplified and perfected until it becomes a part of our every day existence.

The Unit System reduces the equipment and therefore the cost to a minimum by placing the Aero Pulverizer at the furnace where the coal is fed to the machine undried and is exhausted therefrom directly into the furnace. There are no dryers, no storage or long lines of transportation for the powdered coal, thus eliminating the hazard of fire or explosion.

Each Aero Pulverizer is designed as a complete powdered fuel unit for one furnace. They are built in standard sizes ranging from 600 lbs. to 5000 lbs. of coal per hour.

Bulletin Sent on Request

AERO PULVERIZER COMPANY

165 Broadway
New York

(*Continued from page 52*)

material that was to be handled in the manufacture of steel stampings, prime importance was attached to the layout of the routing of materials.

It may readily be seen why it is so important to design an efficient material handling system about which to construct a factory, when it is realized that the savings made by such a system are often equivalent to the net profits of the business. Many concerns have been able to reduce costs, enabling them to effectively complete, and consequently show a better profit, by installing a better method of materials handling in a factory already in operation. It behooves owners and managers to stop and consider the savings that are being made in newly constructed factories through proper internal transportation systems, and it will also pay them to look into their own factories, and see if it will be possible to employ tractor-trailers to assist them in cutting costs.

For photographs in this issue, not otherwise credited, we are indebted to the courtesy of the following:

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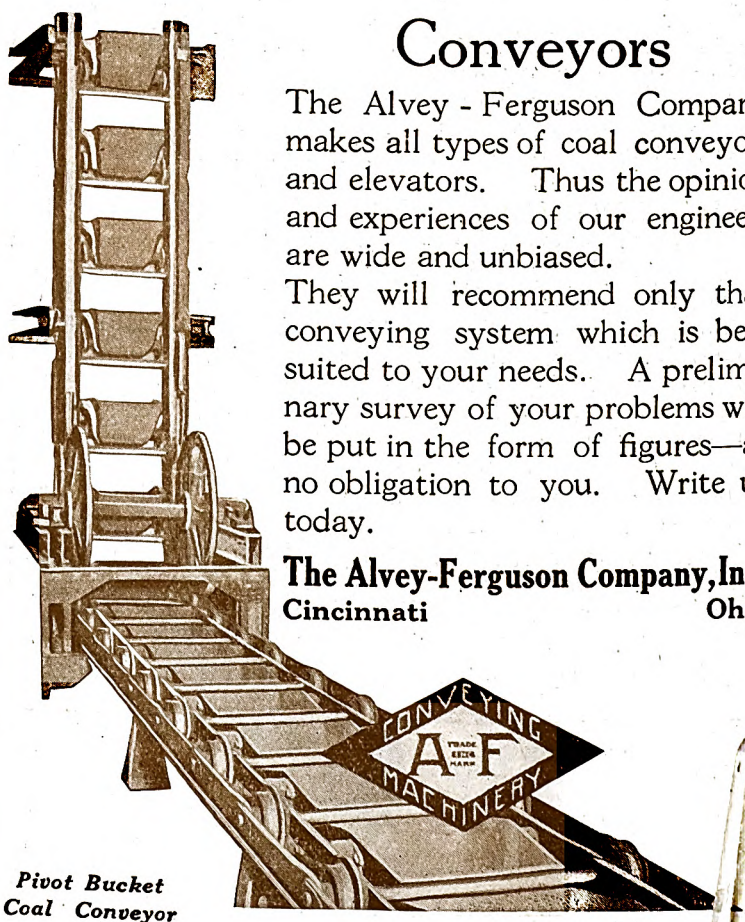


What Is Coal Costing You?

Carload prices are only a part of coal cost. Handling expenses must be added to reach the correct figures.

The h gh cost of coal and labor has made manual unloading and handling practically prohibitive. Mechanical methods effect a surprising annual saving, as evidenced by plants using

CONVEYING A-F TRADE MARK MACHINERY



Pivot Bucket Coal Conveyor

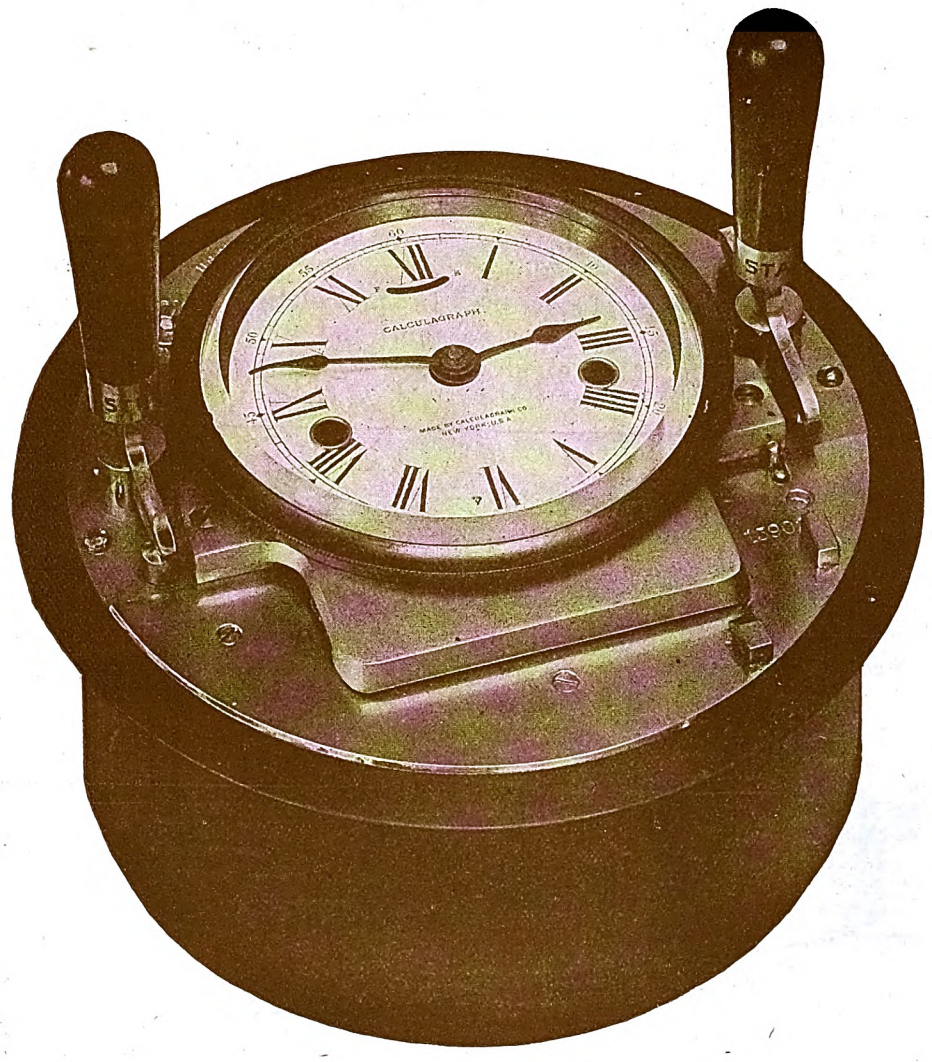
Conveyors

The Alvey - Ferguson Company makes all types of coal conveyors and elevators. Thus the opinion and experiences of our engineers are wide and unbiased.

They will recommend only that conveying system which is best suited to your needs. A preliminary survey of your problems will be put in the form of figures—at no obligation to you. Write us today.

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The Calculagraph Would Have Computed Tom's Time Mechanically

"How long did that job take, Tom?"

"Well, I started it about half-past ten, took half an hour for lunch, and finished at a quarter after three. That makes—let's see—four hours and fifteen minutes. And out of that I helped Bill for about ten minutes. Say four hours."

Do you let your employees figure "elapsed time" the way Tom did?

Not quite so crudely, perhaps.

But do you put it up to your workmen to keep track of the time they have spent on a given job?

Think of the time they lose—and the more conscientious they are the more it amounts to—in figuring it out.

Not to mention the time it takes *other* employees to decipher the often badly written work tickets.

How can you expect to get accurate cost sheets, in which labor plays such an important part, by any such crude methods?

There is only one modern way to do it—by the Calculagraph.

For the Calculagraph figures elapsed time in one operation—instantaneously, accurately, legibly. You merely put in your work ticket, pull two levers, and the job is figured for you.

The Calculagraph takes the guess out of cost sheets. It saves its first cost over and over again in a year. It is an essential part of the equipment of a modern factory.

If you would like to see how the Calculagraph works, and how it can be applied to your business, send for booklet "Elapsed Time Records."

THE CALCULAGRAPH

THE ELAPSED TIME RECORDER

34 Church Street, New York City

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Making Bodies for Ford Cars

(*Continued from page 13*)

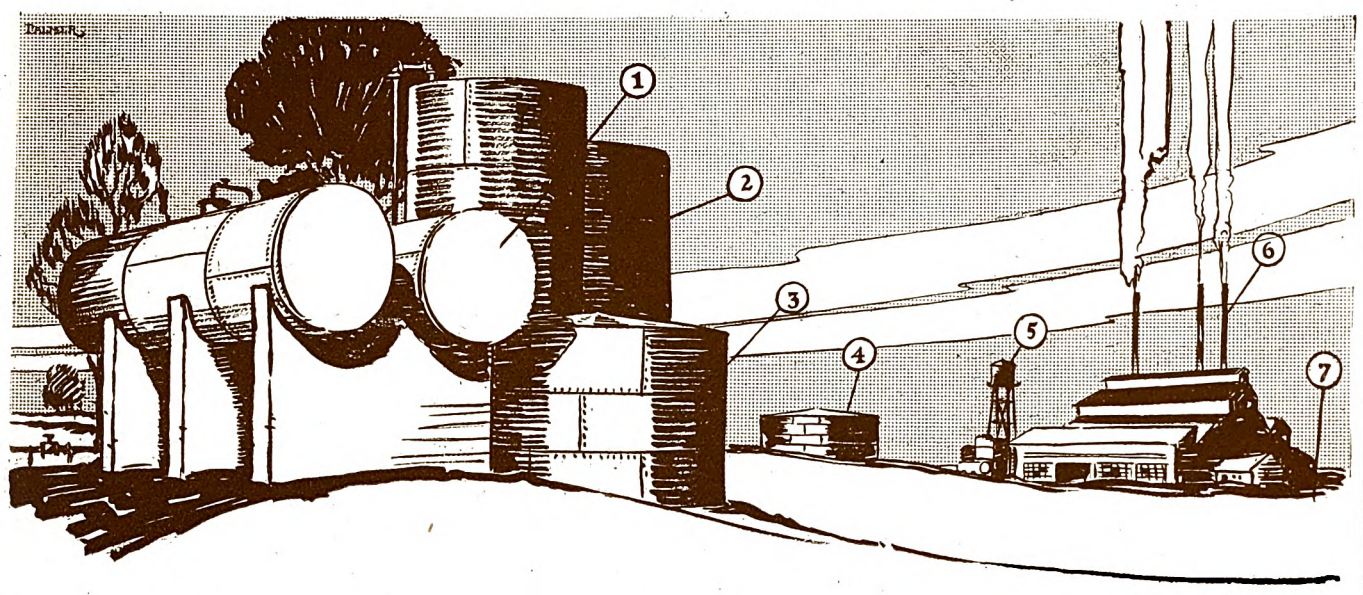
beams and structural shapes, nor does wood equal these other materials in uniformity of texture. Knots and checks, for example, have a disturbing way of appearing in inconvenient places. And so in the conduct of the saws, where the scheduling of production virtually begins, or where, in other words, the decision is made as to just what part shall be made out of each board, there lies surprising potentialities either for waste or for economy.

In examining the wooden frame work of Ford cars of every body type the visitor finds a complete freedom from knots and checks. This is true even on parts and in places where they would do no harm. In spite of this careful inspection and selection, however, some sixty per cent. of the total footage sawn daily is actually turned into body parts. In other words, the board foot contents of the finished parts made from a day's cutting will amount to sixty per cent. of the original footage sawn. The remaining forty per cent., however, is not loss as we shall see later. When it is considered, however, that in many body plants where knots are not taboo, the average utilization falls to forty per cent. or below, these figures take on their true significance.

The secret of this remarkable utilization, as said before, lies in the sawing. In many, perhaps it may be said in the average woodworking plant, if a thousand pieces of a certain dimension are to be made the sawyer will get an order for a thousand pieces of certain thickness, width, length and kind of wood, and will proceed to saw up the stock straightaway as it comes, cutting out knots where too near the edge of a cut and discarding leftovers from the end of the board. In the Ford body plant no straightaway sawing is permitted. Each swing saw takes care of a certain thickness of board and is provided with from five to seven stops permitting five to seven distinct pieces to be sawn according to the sawyer's judgment. With this leeway and with men carefully trained to use it, there is surprisingly little waste at the saws.

All through the subsequent operations each workman is alert to save pieces of stock which may be successfully made into something smaller but which would normally be regarded as waste and thrown away. This practice extends to even tree cornered and other odd shaped cuttings from band saws. So far does Mr. Ford's insistence on this practice go that he has these odd shapes collected in burlap bags and saved for utilization. Some of this utilization cannot be had by making product parts for the reason that there are not enough of these small product parts to use up all of this waste. In this case some other product must be found for which this is suitable raw material, whether it be small handles,

(*Continued on page 58*)



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There are so many kinds and varieties of Tanks for containing or storing so many different kinds of materials that the question of the Right Tank is often confusing even to an expert buyer.

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Our Service Department has compiled three books of practical value to users of Tanks. BOOK J-1, Prices and Specifications 303 sizes Horizontal Storage Tanks, 100 to 25,000 Gallons. BOOK J-2, Storage Tanks from 1,000 to 74,000 Barrels, BOOK J-3, Prices and Specifications of 134 Standard Sizes Pressure Tanks. Any or all of these books sent free upon request.

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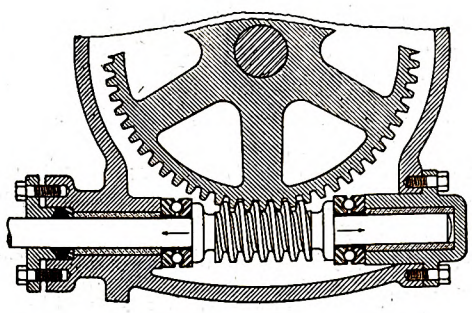
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The investment is small. May we talk them over with you? For whom shall we ask?

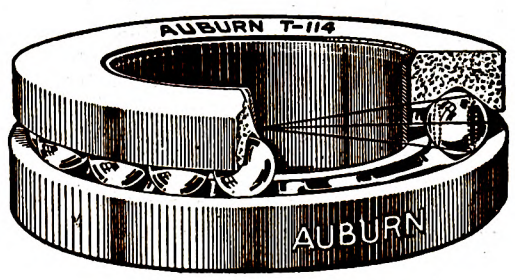
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Auburn Ball Bearings on Worm Drives mean maintained alignment, reduced friction and wear, less attention for bearing takeups and renewals.

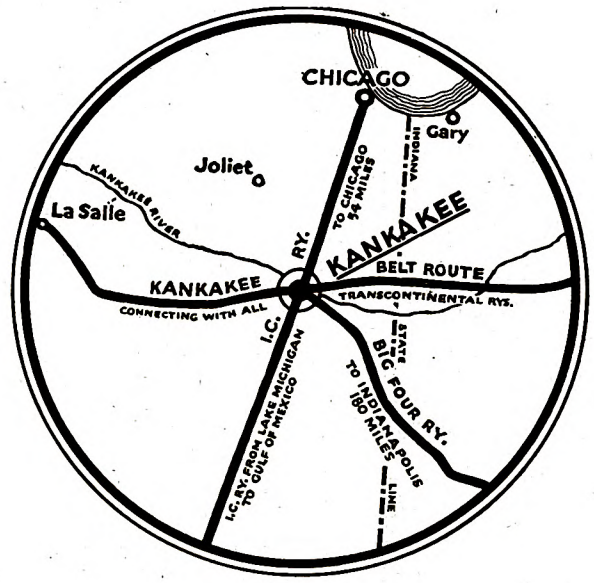
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KANKAKEE ILLINOIS offers an unusual combination of favorable circumstances for the industry seeking a location. It has all the advantages of a moderate sized town, yet is within 90 minutes of Chicago.

KANKAKEE enjoys the same freight rates and divisions as Chicago. But it does not have the congestion of the bigger city.

Located in the heart of the middle west, where industry is moving. Close to the great Gary steel district. An open shop town with a plentiful supply of skilled and casual labor. Eight-eight per cent of Kankakee's population is native white.

Coal within twenty-five miles. Water power from the Kankakee river. Public utilities from the great Public Utility Companies of Chicago. Forty-four steam passenger trains 98 freight trains, 12 interurban passenger trains, and 2 interurban freight trains pass through Kankakee daily.

If you are seeking a new location for your plant, or considering the establishment of a middle-west branch, write for the complete story of Kankakee.

J. N. SLETTEN, Secretary
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KANKAKEE
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(Continued from page 56)

spools, or wooden novelties.

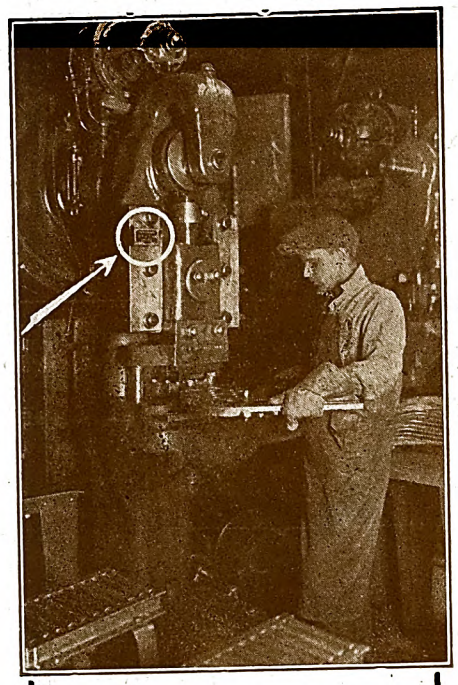
The first stage of side frame assembly consists in attaching the body brackets and cowl pillars at the ends of the sill. Body brackets are prepared ready for bolting to the sill on two double benches at the origin of the assembling conveyor, and are attached to the sill on the conveyor, on the move. For the assembly of the cowl pillar the sill is removed from the conveyor and taken to one of the double work benches D. This completed, it is placed again on the conveyor and proceeds to the wood frame assembly benches.

These benches are in reality extremely ingenous assembly fixtures in which every detail is the result of long experience. They provide not only the means of clamping the sill and cowl pillar securely while adding the remaining wooden parts to the frame, but they also serve as receptacles for all of the screws, nails and tools; the glue pot, and underneath, for the wooden pillars, top members and cross braces.

One framer works at each framing bench. First he takes the sill with body brackets and cowl piller attached from the conveyor and places it on the framing table, fastening it securely with quick-acting clamps. Next he takes the brush from his electrically heated glue pot and applies glue to the gains or notches in which the upright pillars are to be fastened. While he is doing this he has already selected an upright and has prepared it for placing in the sill. Next he fits the cross members and glues them, after which he reaches for a suspended electric portable drill hanging over the table, and drills the screw holes through the wood members. Finally he inserts and tightens the screws, nails the tenons, and the frame is complete, ready for paneling. The entire operation requires about three minutes.

The completed frame, again placed upon the assembling conveyor, proceeds to the paneling benches. There are two sets of these benches on which the metal body panels are attached to the wood frames. One set of these benches is for right-hand side assemblies and the other for left-hand, this

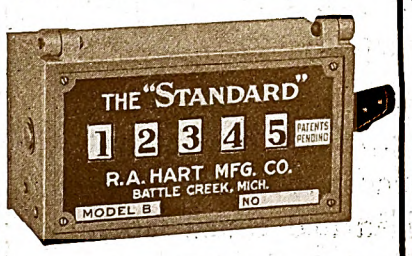
(Continued on page 60)



In the Ford Body Shop Production Checked with model "B" Gear Counters

These give a reliable check on production. And the choice was R. A. HART Gear Counters after thorough investigation of the various methods used in industry for checking output per man.

In the body shop at River Rouge every machine is equipped with a model "B" Gear Counter and throughout the Ford plant 2100 HART Counters are in use. Cost of maintenance almost nothing.



R. A. HART Gear Counters

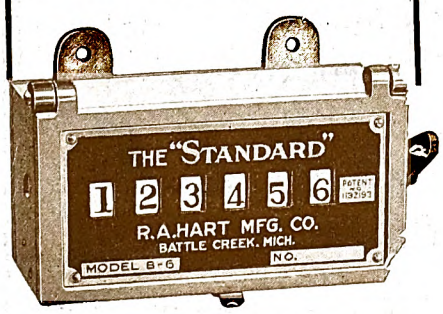
offer a reliable and accurate check on production and output. They show the figures at a glance, at any time.

They register up to 100,000. Constructed on gears—can be reset in a moment.

R. A. HART Counters have large plain figures—Steel Shaft—Steel dogs and Steel rachet wheel hardened.

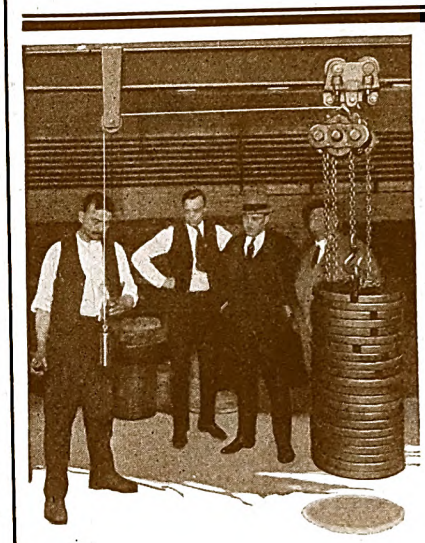
Write for prices and further information.

R. A. HART Mfg. Co.
10 Wilson Court
Battle Creek, Mich.



MATCHLESS TROLLEY

"Easiest to Start-Easiest to Keep Going"



Pulling a 1-ton Load with a 14-lb. Weight

The test shown is graphic proof of the little effort required to start a heavy load and convey it to any desired point, when carried on a Matchless Timken-Roller-Bearing Trolley.

At 14 lbs. the trolley with its 1-ton load, started smoothly and rolled rapidly along the length of the overhead rail.

The Matchless required only about half the pull demanded by any other trolley—ball or roller bearing—when given the same identical test.

Matchless Trolleys in your plant mean less energy used, speedier action and more output per man.

Chisholm-Moore Matchless "Trolleys," "Cyclone" Chain Hoists, and "Carryall" Overhead Track Systems carried in stock by capable distributors in all localities.

Complete catalog, price, and name of nearest representative on request.

The Chisholm-Moore Mfg. Co.
Cleveland, O.

Hoists Cranes Trolleys Overhead Track Systems

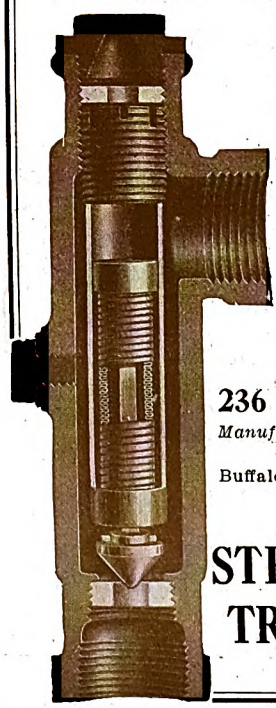
Branches: New York, Chicago, Pittsburgh

1c a Day Saves $5.74 Daily

AN UNTRAPPED ¾-in. steam pipe in your plant would waste 820 lbs. of coal every 24 hours. At the present cost of coal that means a loss of $5.74 a day—$1,722 a year.

Perhaps there are several untrapped or poorly trapped lines in YOUR plant at this moment! If so, you can prevent enormous waste by installing the Steam Trap Sarco. The ¾-inch size costs only $9.45 list.

At that price the Sarco will cost about 1c a day even if you charge off 33⅓% of its cost per year. And after three years it will go right on saving money for years, at no cost to you—for thousands of Sarcos have been in continuous service for more than ten years.



Isn't the Sarco a worth-while investment on that basis, especially when you may try it 30 days without charge and demonstrate that it will do as claimed?

You can purchase three Sarcos for the price of one bucket type trap, and the Sarco will do the same work.

In addition, the Sarco screws right into your pipe line and eliminates the cost of building a platform or digging a pit.

Write today for Booklet R-33 and follow the road to steam conservation

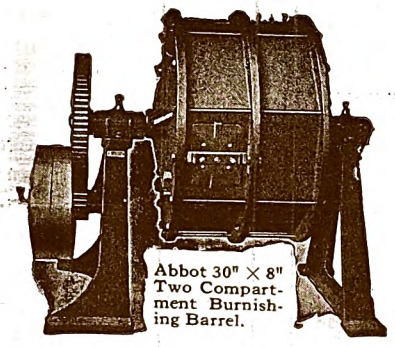
SARCO CO., Inc.
236 Broadway New York City

Manufacturers of Steam Traps, Radiator Traps, Temperature Regulators, Indicating Thermometers, Strainers, etc.

Buffalo Chicago Cleveland Detroit Philadelphia
Peacock Bros., Limited, Montreal

STEAM TRAP **SARCO**

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FREE PROOF

To those manufacturers of small metal parts who do not know the advantages of the Abbott Method of Polishing—but would like to have the satisfaction of knowing, positively, that they can reduce the expenses of their finishing department—we will polish samples of work without cost.

The Abbott Method is equally efficient on steel, brass, copper, nickel, silver and gold.

Send samples and ask for catalog.

Originators of Commercial Ball Burnishing

THE ABBOTT BALL COMPANY

Box 312 A **Elmwood, Conn.**



Right Here

is the Greatest Money-Saving Section of this Conveyor

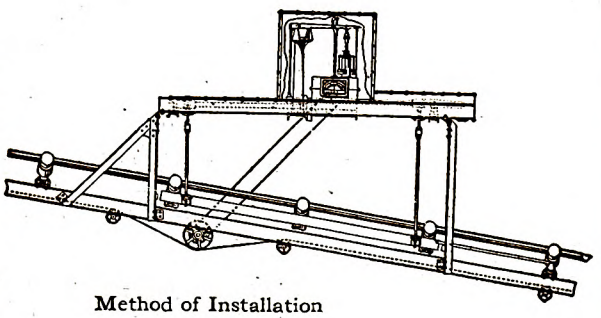
The Merrick Weightometer weighs all conveyor-handled materials ***while in transit*** and is ***guaranteed to be 99% accurate.***

No labor is required, as it weighs automatically and records the weight of the materials as they pass thru.

Send for the "Merrick Circulars," which contain graphic descriptions of the many types of installations. No obligation—glad to send them on request.

The MERRICK CONVEYER Weightometer

is in use in hundred of plants for weighing Coal, run o'mine and crushed; Coke, Stone, coarse and fine; Gravel, Sand, Cement Rock, Phosphate Rock, Phosphate Pebbles, Wood Chips, Sulphite Pulp Slabs, Fish and Fish Products, Ores, Etc.



Method of Installation

MERRICK SCALE MFG. CO.

180 Autumn St., Passaic, N. J.

THE TOWMOTOR *VS* THE LABOR SHORTAGE

THE TORBENSEN AXLE CO.
MANUFACTURERS OF
TORBENSEN INTERNAL GEAR TRUCK DRIVE
CLEVELAND

The Towmotor Co.
Cleveland, Ohio.

Attention—Mr. F. W. Sears

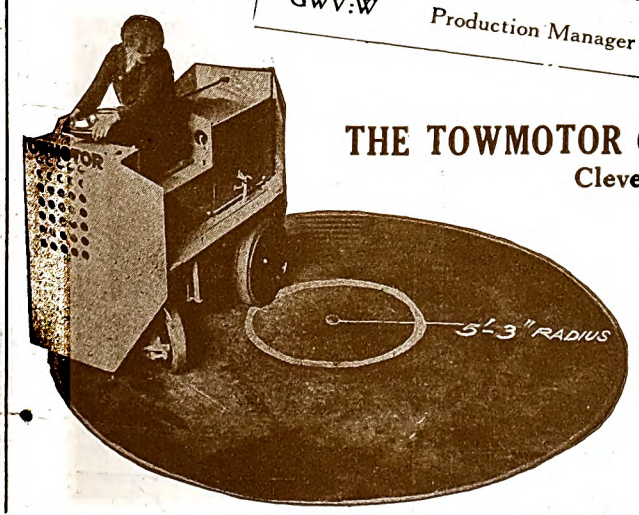
Gentlemen:

With reference to the Towmotor which we recently bought from you, as you know, we bought this machine only after making a very thorough investigation and after several days experimenting on our shipping dock with this and other types of machines. This fact alone indicates that we are well satisfied that the Towmotor will do our work in an efficient manner.

Very truly yours,
The Torbensen Axle Company

Signed:

GWV:W Production Manager



THE TOWMOTOR COMPANY
Cleveland, Ohio

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(Continued from page 58)

necessitated by the fact that the two sides differ, not only in hand but in the fact of having a blind door on the left-hand or driver's side.

The paneling benches are worked out with the same care and ingenuity as the framing benches. They differ, however, in that three men are assigned to each bench. First the rear one-quarter and side panels are placed in the jig after which the wooden frame is superimposed, the panel flanges then are hammered down and nailed and the paneling is completed. This operation takes approximately a minute and a half after which the assembly is again laid on the assembly conveyors, to proceed to the door hanging lines shown in the diagram at F, where the doors are hung and fitted. En route to this point various dinging and smoothing tables are passed where pieces that contain bumps or dents in the sheet metal undergo treatment.

The door hanging lines are progressive lines consisting of work tables on which the paneled side frames are placed in upright position, and held by quick acting clamps while the various operations are performed. For the touring car there are four stations, each side being slid from one to the next upon completion of each operation. A side frame complete with its metal paneling but without doors, is first placed on this line. It is then drilled to templet for hinge screws, after which it is slid back to the second position where the door latch catch is fitted. Progressing to the third position, the door is hung and two screws driven home, while in the fourth or last position the remaining screws are driven and the door fitted to swing and catch properly.

The doors being hung, the side frame assembly is placed on the belt conveyor which carries it to the finishing tables. Here the assembly is gone over carefully by experts and the finishing touches which may be needed are added. This completed, the assembly is hung like a side of beef on the trolley conveyor, which carries it to the paint spraying hoods.

The exterior finishing of all Ford bodies is taken care of at the branch assembling plants. Therefore, the spray hoods mentioned above are used merely for coating the inside of the frames and doors to protect the metal from rust and the wood from decay. A black asphaltum mixture is sprayed over these parts, the frame being rehung on the conveyor which carries it to the edge of the mezzanine and down to the central shipping bay. Descending on an incline along the line, this conveyor carries the frames to the extremity of the car loading area and then makes a 180 deg. turn, bringing the bodies in endless procession past the doors of the waiting freight cars. Thus the bulkiest parts of the entire shipment are brought directly to the cars by mechanical transportation, each shipper picking off the number of right and left hand sides that he requires to make up his car, whether this be a shipment of touring cars or roadsters.

Specializing in "licking trouble"

Standardizing on difficult castings

We are *not* interested in the kind of castings that any ordinary foundry can produce satisfactorily.

We *are* interested in those that the ordinary foundry can*not* produce satisfactorily.

Our foundry, our organization, and our methods have been developed to do extraordinary work.

When we use them for ordinary work we are guilty of waste.

Practically all the work we do consists of jobs on which other foundries have failed in one of two ways.

Uniformly satisfactory

Either they have failed *entirely* to produce any satisfactory castings, or, more frequently, they have failed to produce castings that were *uniformly* satisfactory.

Our customers consist of organizations who have found that even though rejected castings are paid for by the foundry, no one can pay them for the troubles, costs and delays always attending rejections.

Send blue prints

Send us your blue prints for jobs with which you are having trouble.

Our specialty is "licking trouble" and keeping it "licked."

We are not interested in ordinary work that an ordinary foundry can do well enough.

Nugent Steel Castings Company

Formerly ELECTRIC STEEL COMPANY

Wood and 31st Streets, Chicago, Illinois

NUGENT STEEL NS

When writing advertisers please mention Industry Illustrated

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Eliminating The "Take Homes" of Lamp Bulbs and Increasing Operating Efficiency Through Lamp Guards

When "A" slips a light bulb into his pocket on the way out of the factory, he thinks nothing more of it than if you carried home a pencil or a rubber band. It is not "theft".

But purchasing departments and superintendents keeping records almost always find a steady outward flow of unprotected bulbs—and because the loss runs into considerable figures in the course of a year, they have adopted in many cases, the simple expedient of guarding their lamps.

Generally they will first buy guards for a limited number of "exposed" lamps. But if "A" wants a lamp he will stand on a box to get it and after a short trial the order for guards is generally enlarged to cover practically all lights in the plant.

To the average workman the sight of the guard over the lamp is sufficient deterrent to discourage any attempt to take the bulb.

On the other hand, there is always present some of the type which show their skill in defeating the intent of the guard. They think it a good joke to take the lamp out of the socket, leaving the guard intact, but empty.

The second class, the man who figures out how to take the lamp and leave the guard intact, is the one who gives us real concern. He can extract a lamp from an ordinary guard in less time than it takes to tell, Mind you, he seldom removes the guard for he has learned that without the key the present day lock used on guards is hard to open and close.



A third class is the man who destroys the guard in order to take the lamp or who takes the guard and lamp. Such an individual is very rare and except in cases of flagrant theft for resale purposes is seldom encountered.

Reflector Type Guards.

Before discussing the most efficient type of guard, it is adviseable to mention the modern reflector guard.

Most of these guards are employed in and around shops where machine work must be closely watched and where an open lamp would tend to blind the workman's vision and make his work less effective.

However, don't think that because you may have never had a call for guards of this type, that your shop does not need them. Take a walk around and see. "A" is resourceful. He has already placed a piece of cardboard, sheet metal or some such device over his lamp. Considerations of accident or fire resulting from this action are none of his affair.

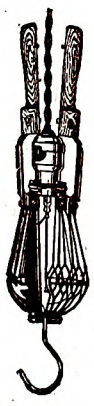
He wanted his eyes shaded and he took the shortest route.



The Effective Type of Guard

Without going into any competitive comparison, we believe it fair to state that the FLEXCO and FLEXCO-LOK expanded steel guards most effectively prevent the unauthorized removal, while protecting lamps from breakage.

For a number of years we studied this problem. Finally the present FLEXCO-LOK and FLEXCO re-enforced expanded steel guard was perfected. Because of its scientific design it affords maximum lamp protection without objectionable shadows.



The fact that these guards have developed a steadily increasing demand, indicates their effectiveness.

A complete line of guards to fit standard brass and weather proof sockets to 1-5/8" diameter to effectively protect bulbs up to and including 200 watt pear shaped lamps. The reflector guards are made for lamp sizes up to 75 watt.

They are made with plain round head screws (FLEXCO) or key locking screws (FLEXCO-LOK).

A new guard which has recently proven very popular in our FLEXCO "Universal" which can be used for mill type or straight side lamps from 10 to 50 watt. It is adjusted at the collar with two bolts instead of plain screws and is made either in regular or reflector type. All FLEXCO "Universals" are adjustable to either brass or weather proof sockets to 1-1/2" diameter.

Still another, the split handle portable type guard has a very definite field in power plant operations, automobile repair work and elsewhere. Our line of these guards made in either regular or reflector type covers all ordinary requirements. Aside from the superiority of the construction of the guard, these lamps have split handles. This feature saves rewiring and time loss which is met when the handle is simply bored for the cord to pass through.



A Trial Test at Our Expense

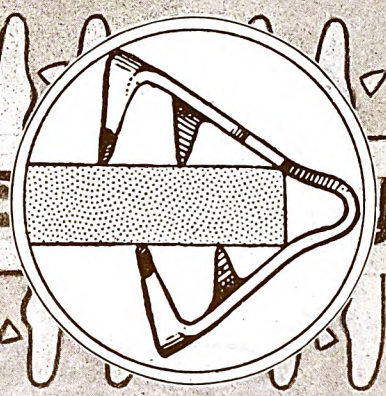
To any prospective user of our guards writing us on his company letter head before December 1st., we shall be glad to send with our compliments, a 50 watt size FLEXCO-LOK guard. State kind of socket used and if weatherproof, give diameter of socket at space next to or between shade holder rings.

Flexible Steel Lacing Co., 4639 Lexington St., Chicago.

ALLIGATOR

TRADE MARK REG. U. S. PAT. OFFICE

STEEL BELT LACING



The Modern Idea in Lacing

Old time lacings pulled against only part of the fabric. Modern Alligator Steel Belt Lacing pulls the entire fabric as a unit.

The teeth penetrate lengthwise and clinch down, each one a vise; binding the entire width of the belt in a grip of steel.

Alligator Steel Belt Lacing has every essential point of a perfect lacing; a tremendous reserve strength, quick, easy application, economy, an easily separable hinged joint no thicker than the belt. Smooth and flexible. "Just a hammer to apply it."

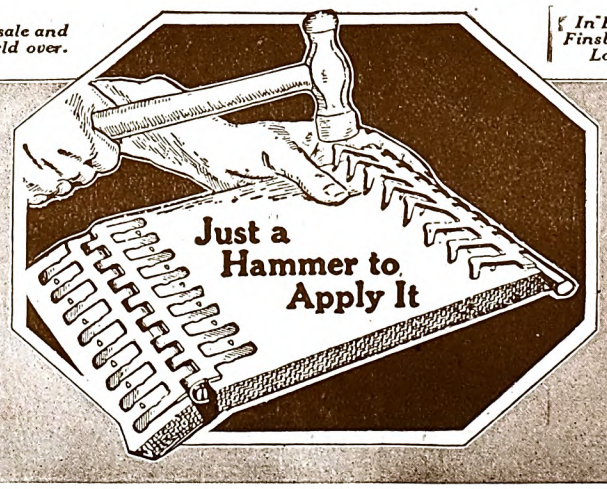
Made in complete range of sizes for belts of every material and thickness. Recommended and used in universal service. Investigate!

FLEXIBLE STEEL LACING CO.

4639 Lexington Street, Chicago.

Sold at wholesale and retail the world over.

In England at 135 Finsbury Pavement, London, E. C. 2



"Every Tooth A Vise"

For Every Size and Kind of Belt

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Industrial Americanization that Pays

(*Continued from page 15*)

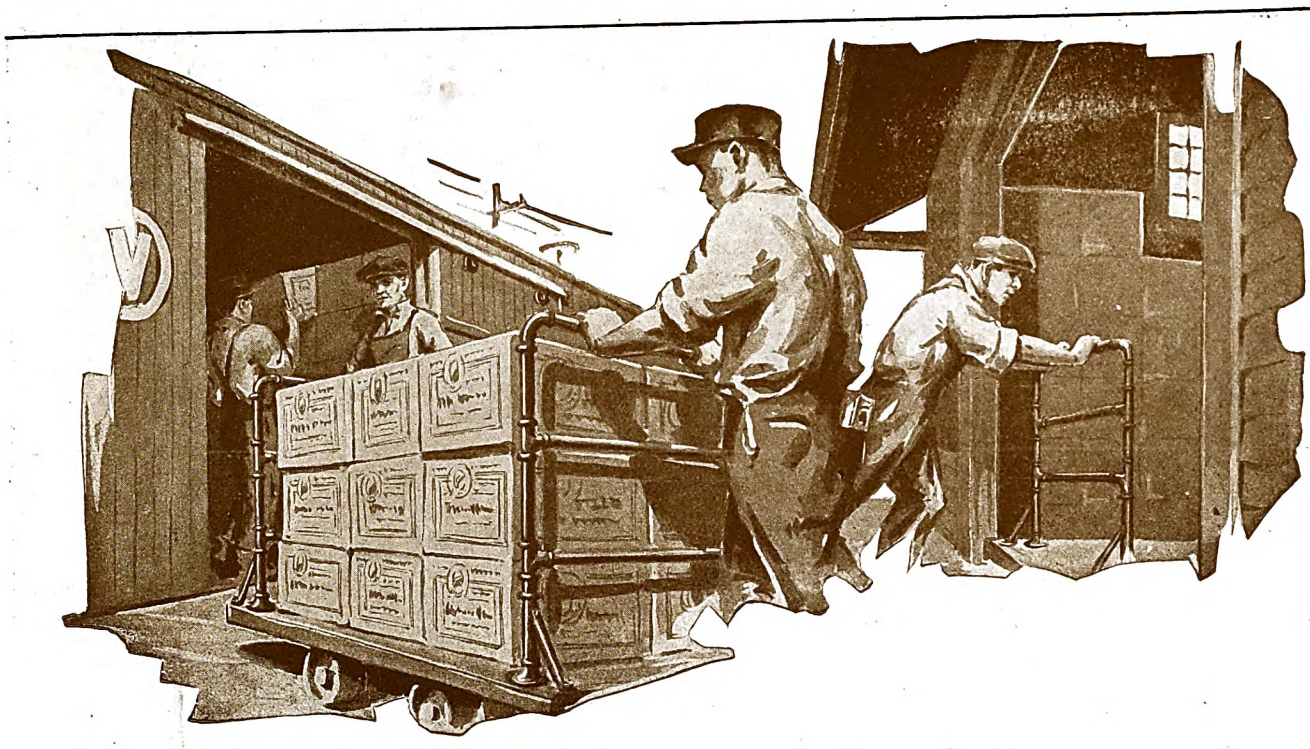
vaks and 3,000,000 Yiddish speaking people. Some of the largest foreign cities in the world are in the United States of America and three-fourths of the foreigners live in the cities. Huddled together in isolated communities they become an easy prey to grafters and agitators. Many have made good in America and others have been bitterly disappointed. They were met upon landing by unscrupulous exploiters of all descriptions. They were forced to live in unsanitary tenements. They were fleeced by padrones and fake employment agents. They were handled unsympathetically by bosses and foremen. They earned considerable money, but saved little because of high costs. They exchanged green fields for smoky steel mills and left beautiful cathedrals to be invited to cold churches or bare missions. Small wonder that they have not always overwhelmed us with expressions of gratitude and become citizens overnight!

Problems? Of course they present problems of ignorance and unassimilability. The illiteracy of Southern Italians is 54.2 per cent. of Croatians and Slovenians 36.4, of Polish 35.4; but some of them like the Czechs have a lower rate of illiteracy than us native Americans! It is true that they remain here on the average over six years before securing "first papers" and five years more before completing citizenship, but we must blame our faulty processes of education and our antiquated laws, partly at least, for that!

Opportunities? They are unlimited: To create right relationships between different racial groups and between these groups and native Americans; to promote social relationships on the basis of mutual acquaintance and appreciation; to appraise the contributions of different nationalities to human progress; to encourage sane methods of Americanization through goodwill, by living up to our ideals affording protection and fair treatment; and increasing coöperation and a respect for all races and colors! And, I repeat, this is to a large extent the task of industry.

New York State alone has more than 2,850,000 foreign born, only half of whom are naturalized. About 6,000,000 people live in New York City and 77 per cent. of these were foreign born or of immediate foreign descent. Amazing but true! But the situation is far from hopeless. Whereas 13.1 per cent. of all the foreign born in America are illiterate, only .8 of one per cent. of those of foreign parentage are illiterate, and this is a better showing than that of the native born whites (2.5 per cent)!

The big question before the country today is whether we shall have more or less immigration. Many industries complain of a labor shortage. Although our new restriction law allowed 357,803 to enter America last fiscal year, the quotas were not filled and many left



Good Boxes Pay

SHIPPING BOXES play an extremely important part in the ***profitable*** marketing of goods—and they should be chosen with the extreme care their importance warrants.

Between factory doors and the distant counters of dealers, stand "hurdles" that every shipper must meet. Numerous handlings of your merchandise by disinterested and none-too-careful hands—jolting trips in swaying freight cars—crushing pressure from piled-up merchandise—falls from platforms and trucks—these and a score of other potentially destructive factors lie in readiness to assail every shipment you make.
That is why ***only good dependable boxes*** should ***ever*** be used—and "H & D Service" is supplying more than forty millions of such boxes every year.

H & D Corrugated Fibre Boxes

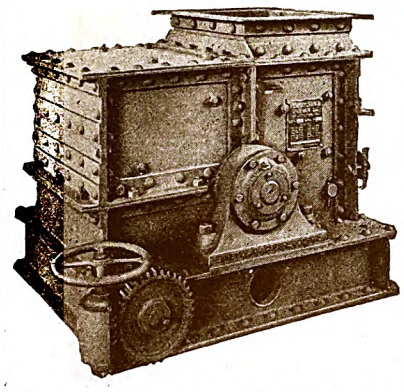
are justly famous throughout the shipping world for their rugged sturdiness, their absolute dependability and their unmatched economy. If you are interested in the cutting of your packing and shipping costs and want to improve upon your present boxes, let us lay the complete H & D facts before you. You will find the story of our free box design service particularly helpful. Write, or suggest to your box buyer that he get in touch with us.

The Hinde & Dauch Paper Co.
299 Water St. Sandusky, Ohio.
Send us the H & D Box Catalog and full details of your Free Box Design Service.
Name .....
Address .....
.....
We are shippers of.....
.....

The Hinde & Dauch Paper Co.
299 Water St. Sandusky, Ohio.
In Canada: Toronto — King St. Subway and Hanna Ave.

The World's Largest Manufacturers of Corrugated Fibre Boxes and Packing Materials.

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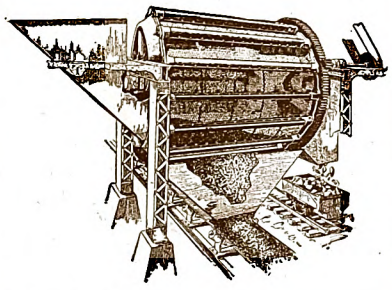


HAMMER CRUSHERS

39 Sizes

For Coal, Lime, Limestone, Shale, etc.

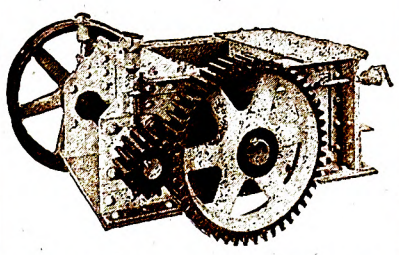
(a) Unbreakable Steel Frame
(b) Quick Adjusting Cage
(c) Oversize Bearings
(d) Patented Tramp Iron Separator
(e) Maganese Steel Wear Parts



BRADFORD BREAKERS

31 Sizes

Crushes and **automatically cleans** and prepares Stoker Coals, By-Product Coals, Gas House Coals and reclaims "Gob" coals. BREAKER UNDAMAGED BY TRAMP IRON.



SINGLE ROLL CRUSHERS

35 Sizes

For Coal, Lime, Limestone, Shale, etc. A remarkable Preliminary Crusher.

PENNSYLVANIA CRUSHER COMPANY

Stephen Girard Bldg., Philadelphia.
New York Pittsburgh Chicago

here for Europe. Of those entering 32,724 were laborers, but over twice that number of laborers left the country! A special committee of the National Manufacturers' Association recently urged:

"1. That in fixing the quota of each nationality of otherwise admissible aliens under the present law, due regard should be given to ascertain annual emigration of such nationality. The Italian quota under the law last year was 42,000. Substantially 40,000 Italian immigrants entered the United States—53,000 emigrated. Thus, while the Italian quota was apparently satisfied, there was a large actual deficit. In other words, Congress should fix the quota in terms of net immigration.

"2. The Secretary of Labor should be authorized, upon the presentation to him of satisfactory evidence of a continuing shortage of labor of a particular class or type, to admit otherwise admissible aliens in excess of quota until in his judgment such condition is improved.

"3. Provision should be immediately made to provide for physical examination of aliens through a detail of United States medical officers at the point where passports are visaed or at convenient points of embarkation."

The Association also announced the following fundamentals for an immigration law:

"That the United States should retain the tests for mental, moral and political quality fixed in the law of 1917, except the literacy test, which we believe experience has demonstrated to be an ineffective means of determining the quality of an alien.

"That distinction be made between the above requirements for admission and those for naturalization, the latter requiring as a condition of citizenship a working knowledge of English and a practical understanding of the form and purpose of American Government and evidence of attachment to its principles.

"That the United States assert the right to register, distribute, educate and otherwise supervise the alien during the period of his alienage.

"That all immigration legislation be administered through



The man who led a triple life *in business*



W. J. SCHOONOVER
who multiplied his success by three and collected salaries from his other two selves.

WHEN Mr. W. J. Schoonover first saw an advertisement of this sort and sent for the little book "Forging Ahead in Business," which is offered below, he was thirty-five years old. He was treasurer of his own business, a glass warehouse in Scranton, Pennsylvania.

It seemed to him that he was as busy as a man ought to be, and that things were coming his way about as fast as they should.

That was seven years ago. Recently he wrote a letter about his experience with the Institute Course and Service which emphasizes several important points.

He was prepared to find the Course helpful, he says, but was surprised to find it so "interesting," so easily "understandable," and so directly applicable to "actual business situations."

The "direct result" of this Course

But the important paragraph in his letter is this:

"The direct results to me from the use of this Course are that I have been able to enlarge my business from one factory and office to its present dimensions of three factories and offices and, with the development of administrative ability, *I find that I can more easily handle the three than I formerly did the one.*"

With no strain, or effort—simply by developing his unused reserves—he had multiplied his business effectiveness by three.

Thousands have realized their opportunities

It would be easy to fill pages of this magazine with such letters. Sometimes they tell of enlarged responsibilities; sometimes of multiplied income; sometimes of the realization of opportunities that had previously seemed out of reach.

But the lesson of all of them is the same—business *does* pay its largest rewards to men who have business training; and opportunities *do* come to those who have the courage and self-confidence to reach out and take them.

The total number of men who have enrolled in the Alexander Hamilton Institute is now beyond the 200,000 mark. Of this, 27,198 are presidents; 8,294 are vice-presidents. *But* thousands were subordinates when they enrolled—department heads, accountants, engineers, salesmen, clerks.

Somewhere in this army is a man whose salary and position when he enrolled were precisely like yours. Isn't the experience of these other men evidence that this training is worth your investigation?

YOU can have the facts

Investigation is not difficult; the Institute welcomes it. It seeks to persuade no man; it asks only for an opportunity to lay the full facts before you. The facts are published in the 118-page book, "Forging Ahead in Business," which was Mr. Schoonover's introduction to the Institute, and has given a new direction to the business progress of so many other men.

The cost is nothing; the reward may be a new vision of your own powers which will enable you, as it did Mr. Schoonover, to triple your business capacity—to collect salaries from your two other selves.

Mail this Coupon today

Alexander Hamilton Institute
848 Astor Place, New York

Send me "Forging Ahead in Business," which I may keep without obligation.

Name .....
Print here
Business Address .....
.....
Business Position .....

Alexander Hamilton Institute, Limited,
C. P. R. Building, Toronto.
Australian Address, 42 Hunter Street, Sydney.

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a board composed of the Secretaries of Agriculture, Commerce and Labor, thus securing the coördination of the departments.

"That through the effective coöperation of State authority and private organizations, information as to immigrant needs and opportunities be compiled, analyzed and presented to the Federal Board, and further coöperation be established to present the economic needs of the nation in terms of ascertained fact, to protect the immigrant against exploitation, and secure for him accurate information as to existing opportunities throughout the nation."

Of course many objections can be raised against an increased influx of foreigners. It is a biological and political as well as an economic question. For years restrictonists have claimed a lowering of standards due to immigration, and for years the liberals have denied the charge.

There is comparatively little scientific data on the subject. Some claim that the position of American labor is not improved by restrictions, because the gaps are filled by negro agricultural workers who migrate to industries paying high wages, and by Mexicans. Over 14,000 of the latter entered through El Paso in six months!

In any case the vital question is how we can develop this country in the best way, rather than how we can develop it most rapidly. It is perfectly true that the majority of our recent arrivals have been females and old people, unfitted for hard unskilled labor. Those who suggested a solution of the problem by better distribution of immigrants are met by such a declaration as that of the recent Farmers' National Congress: "Resolved that we are unalterally opposed to the proposed diversion and distribution of aliens over the farming districts until immigration is rigidly restricted, numerically or otherwise."

Whatever side we take on this matter of the open or closed door there can be no argument against a comprehensive, fair-minded program of Americanization for those who are here now and others who are coming!

As Professor Frederick Davenport well says:

"The best way to prevent the dangerous growth of hate, violence, direct actionism, the general strike, dictatorship of the proletariat, communism and all the other dreaded phenomena of unbridled mass action, is just to be human, and let every worthy alien feel and know that government and law and justice in America are on his side just as they are on ours."

And remarks Allen T. Burns:

"Americanization has been considered as the union of native and foreign-born in all the most fundamental relationships and activities of our national life. For Americanization is the uniting foreign with native-born Americans in fuller common understanding and appreciation, to secure by means of self-direction and self-government the highest welfare of all."

I reiterate, this is to a large extent the task of industry! There is no good reason why

(Continued on page 66)

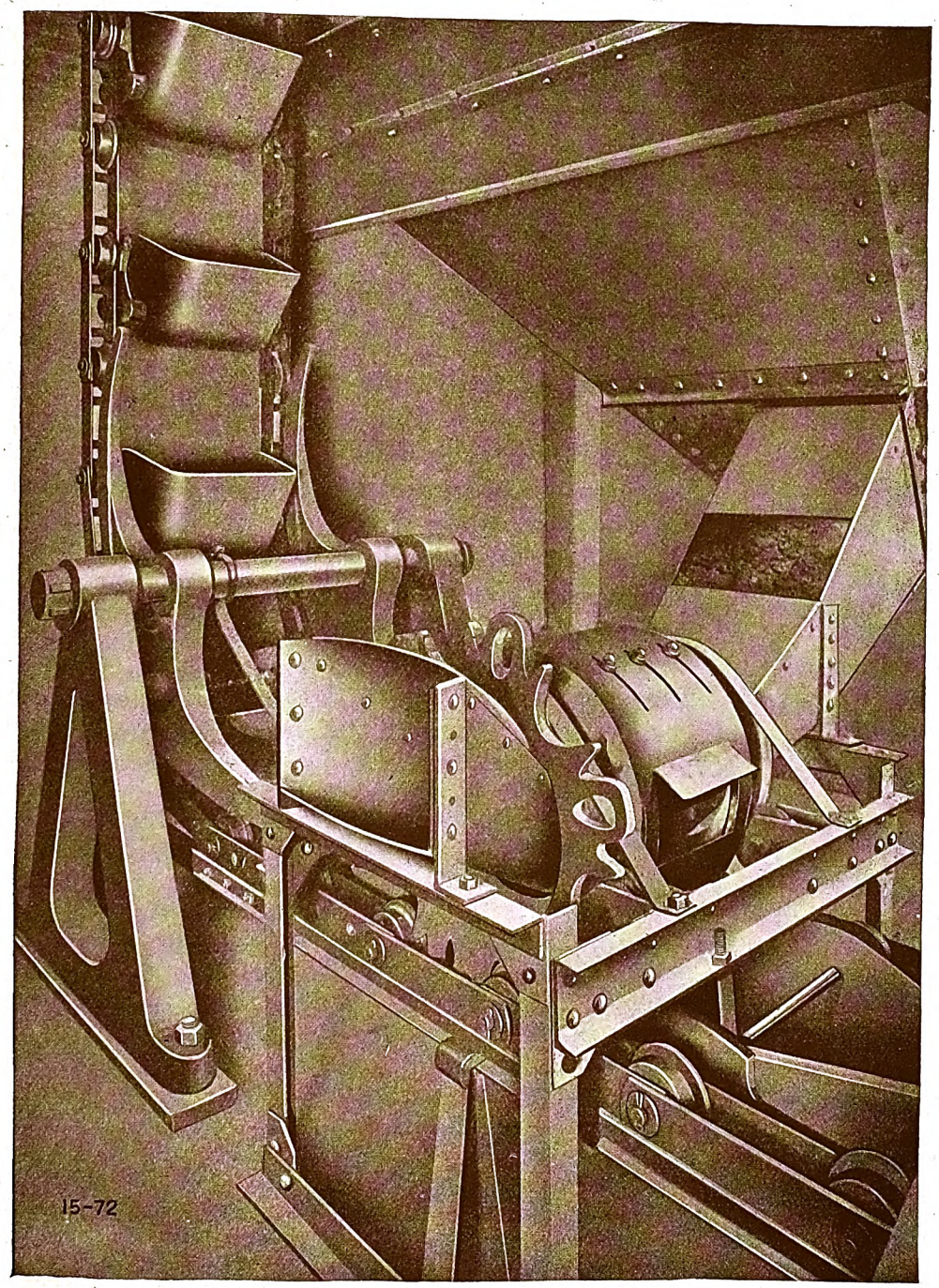


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Cost, more than *Price*, Fixes Profits!

"Many Manufacturers depend on their balance sheets to determine costs," says E. St. Elmo Lewis, in his book "Efficient Cost-Keeping." And, he further states "This is guesswork of the rankest, most treacherous sort."



Hunt Pivoted Bucket Conveyor, showing Filler and fixed curve for cramped quarters.

The buckets are loaded by a filler of the revolving drum type, which is driven from the conveyor chain through a wheel designed to properly engage in the links of the chain. The filler moves in perfect synchronism with the conveyor and gives an equal charge to each bucket, filling each bucket to capacity without spilling the material over the edges or between the buckets. It furthermore prevents dust and grit from getting into the working parts of the conveyor.

This is a stern arraignment of the manufacturer; and unfortunately in a majority of cases it is true. Too much credence is placed on ***"paper costs"*** and not enough on actual data; the result is a wilderness of figures that mean nothing but as Mr. Lewis says, "guesswork of the most treacherous sort."

If your coal and ashes handling costs are excessive,—due to obsolete or unsuitable machinery, faulty systems, or wheelbarrow pushing methods,—they impose a burden that has to be dragged through the entire gamut of costs to the ultimate selling price of your product thus affecting the profit thereon.

Few executives realize that coal and ash handling costs have such a bearing on the profit, but it is nevertheless true; and the greatest care must be exercised in choosing such apparatus for performing this vital operation as will reduce to the minimum these charges.

Hunt Cost-Cutting Equipment has a long record of efficient, economical, time-saving service extending over half a century. A wide variety of industries is represented among users of Hunt Coal and Ashes Handling Machinery; the installations in service ranging from 18 to 35 years with few repairs.

Hunt Engineers with over half a century of experience and a vast amount of practical information accumulated in that long period, are ever willing to help plan a handling system for coal and ashes and other bulk material that will prove satisfactory in every way.

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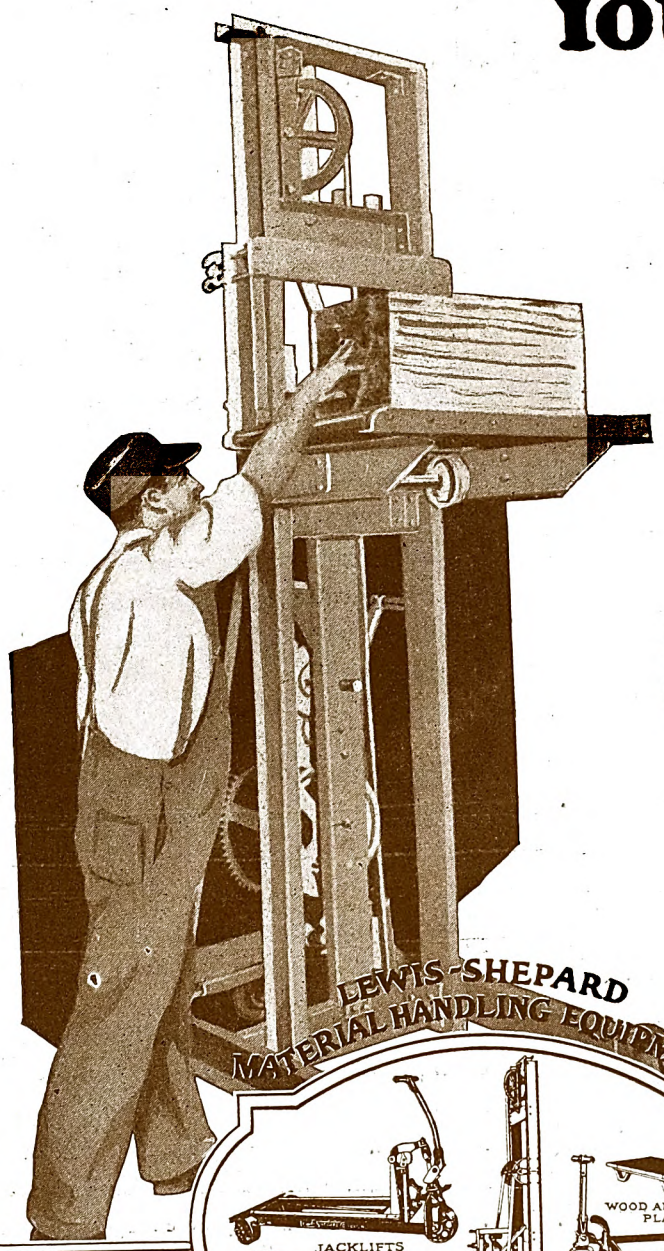
(Continued from page 64)

every plant employing any considerable number of foreign-born should not organize a cosmopolitan Americanization Committee. With the help of this Committee there can be promoted pageants, dramas, song contests, exhibits of foreign handicrafts, folk dances, concerts, athletic demonstrations and celebrations of foreign holidays which will afford opportunity for self-expression and help interpret foreign and American born to each other.

In some ways these activities are even more important than the customary classes and clubs in English and citizenship; health, safety, thrift, clean-up, gardening and other campaigns; noon recreation and athletic leagues; foreign boys' and girls' clubs and outings; shop meetings, lectures, movies and entertainments; legal advice and counsel on safe investments; observation trips to points of historic and civic interest; community parties and socials which bring foreign and American-born together. All these and many other activities constitute an *all-year program of shop Americanization.* Often foreign societies and periodicals, churches and schools, Y. M. C. A. and Y. W. C. A. can coöperate to the greatest advantage. The last two organizations have a world program of service which assists immigrants in countries of origin, frontier towns, ports of embarkation, on shipboard, at chief ports of entry and at final destination. Years of experience and familiarity with best methods make them valuable assets to any industrial operation.

Emigration is the safety valve of some of the countries of Europe. *Americanization is the safety-valve of many industries in America!* In 1861 the problem was to save the nation from being "half slave and half free." In 1923 the problem is to save the nation from being part foreign and part American. Industrial Americanization will be possible not through distasteful compulsion but through generous coöperation, a full regard for the traditions, history and ideals of our racial groups, an increasing emphasis on the importance of the human factor, a program of hospitality, protection, friendship and service and a growing mutual understanding between employer and employee and between foreign and native born!

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Sooner or later you will make this profitable discovery—that Lewis-Shepard Jacklifts, Stackers and Platforms *save* more men and cost less money than any other labor-saving products on the market. Over 600% Profit in One Year! Why delay the discovery.

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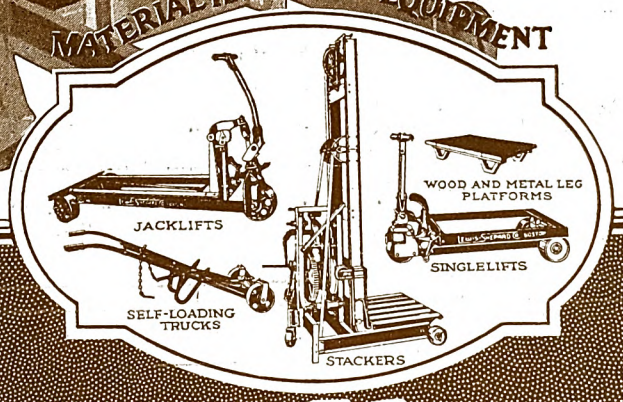
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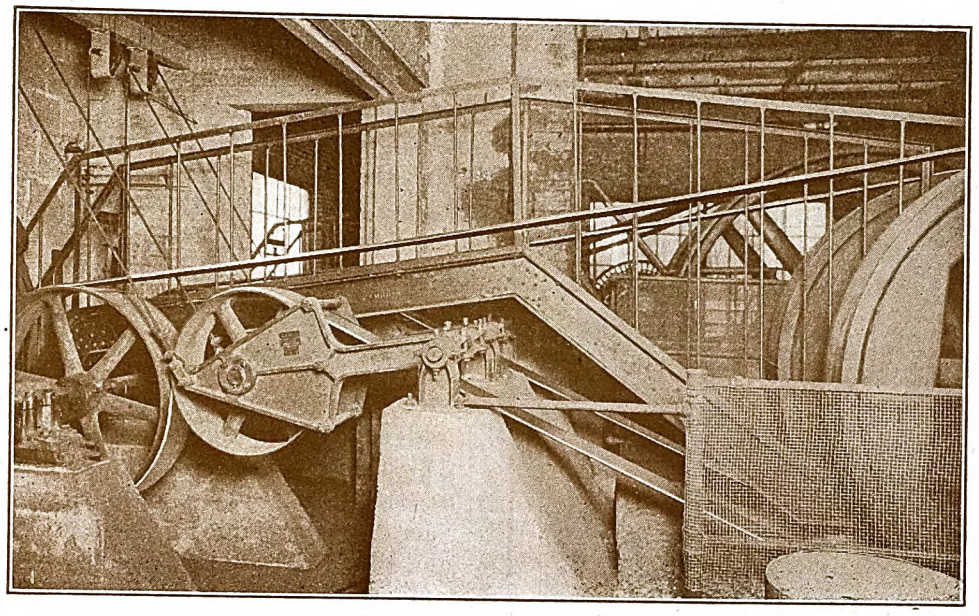
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A report on industrial accidents in the United States has recently been issued by the United States Bureau of Labor Statistics as Bulletin No. 339. About one-half of the report deals with these data in an attempt to show what can be gathered toward a presentation of the accident situation on a national scale. So far as possible the record has been arranged on a uniform classification of industries, cause of injury, nature of injury and location of injury. Unfortunately lack of information regarding the amount of exposure in the various industries renders this body of information very much less significant than it otherwise would be.

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Point Number Two—"Belt Tension"

One of the most difficult problems confronting the operator of a belt drive is to maintain the proper belt tension. This is usually done by moving the motor on its slide rails, or, if there is an idler, by increasing the idler pressure on the slack side of the belt. The tension thus applied is of an unknown degree, guessed at by the man on the job. Overnight changes in temperature and atmospheric conditions add to or subtract from the tension applied in this manner.

What is the result?

It is that the tension in the belt of an open or common idler drive is in nearly all cases much greater than necessary to transmit the load. This means that there is an unnecessary, increased bearing pressure with consequent excessive friction losses of long duration, or the loss of a burned out bearing or motor.

Not so with the *Lenix Drive.*

In the installation illustrated there are two compressors each with two overhung flywheels and two belts, driven from a lineshaft through Lenix Drives. The shaft is turned by a 200 HP motor with a Lenix Drive.

One year of costly experiments proved this installation could not be operated without the Lenix Drive. Without changing the design of the compressors it was necessary to apply two three-ply belts in parallel to each unit.

No two belts of the same specification will stretch to the same degree. Open belt drives could not therefore be employed. With the two Lenix Drives working in Parallel the load of each unit is nicely divided between the two belts and, if necessary, can be adjusted with the drive running. The periodic, wide variation in the power demand of these multistage compressors which caused the failure of metallic and unelastic drives is automatically compensated for by the Lenix and the elasticity of the leather belts.

FIVE POINTS

1—The Lenix increases the arc of contact between belt and pulley.

2—The Lenix maintains constantly and accurately the proper tension in the slack side of the belt.

3—The Lenix saves floor space, building space and belting because of freedom in pulley locations.

4—The Lenix saves in bearing friction, lubrication and renewal of bearings because of reduced bearing pressure.

5—The Lenix permits the use of less expensive, high speed and high efficiency motors or generators because of the higher pulley ratios.

Booklet, "Saving Slippage and Space" tells how is it done. Send for a copy.

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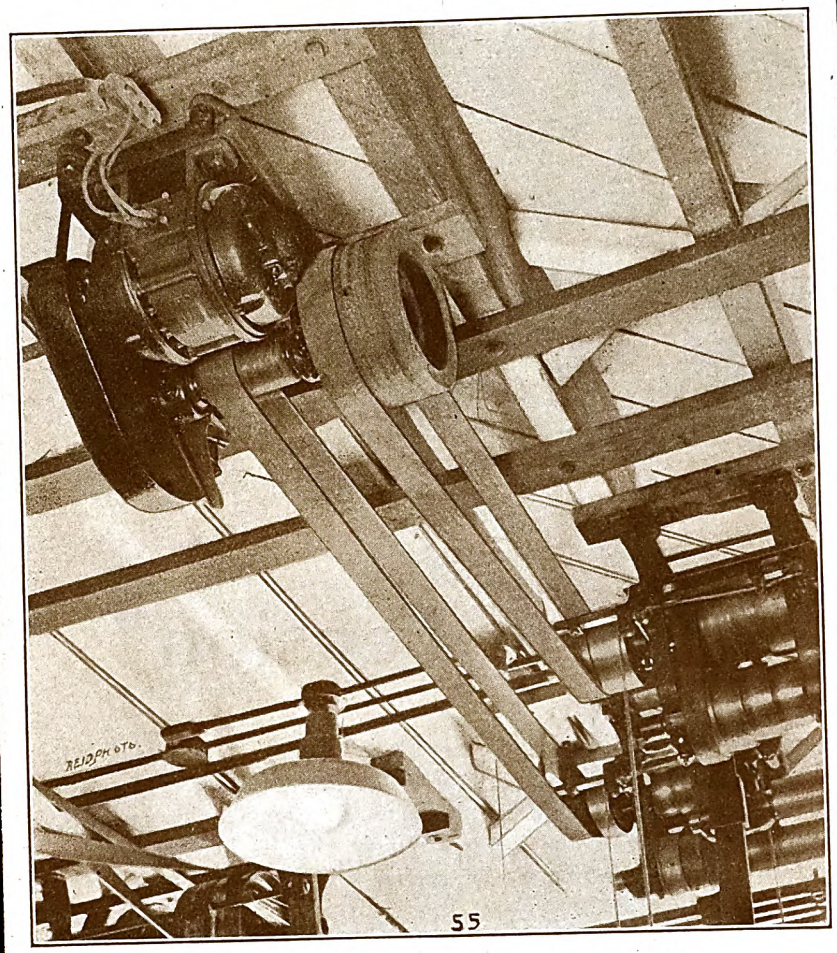
THE LENOX DRIVE

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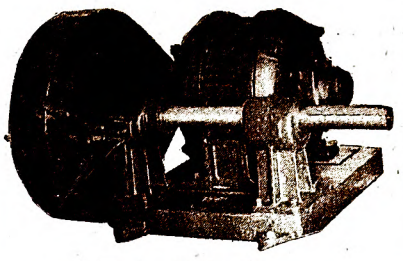
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REDUCTION GEAR DRIVE



STANDARD CEILING MOUNTING UNIT

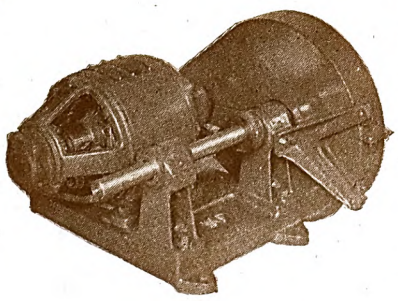
Driving Two Countershafts at Different Speeds



Furnished as Standard Equipment by the better Motor Manufacturers.

Here is another example of the successful application of Watson-Flagg Reduction Gear Drives.

This particular unit has been approved by the Norton Company and will be furnished as optional motor drive equipment for Norton universal tool and cutter grinding machines.



W. F. Reduction Gear Drives have solved many difficult transmission problems. They will fit any make of motor. Perhaps the solution to your problem is just as simple as the above.

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PATERSON, N. J.

Good Housekeeping in the Modern Plant

(*Continued from page 26*)

What is good factory housekeeping? Good factory housekeeping in accident prevention bears the same relation to the shop as the thyroid gland does to the other glands—it is the master gland. Good housekeeping does not mean to rouge the shop, but it does mean to keep it free from debris and the aisles free from obstruction. Ladders should be looked after to see there are no rungs missing. Broken or weak ladders, or ladders with missing rungs should be destroyed. It is recommended that ladders be equipped with metal points or lead coated bases for wooden boors. Carborundum bases for the use on iron floors. Pivoted lead shoes of carborundum are recommended when ladders are to be used on concrete floors, and recessed rubber bases when used on wet floors.

Among the hazards of the machine shop, which might be and usually are productive of serious accidents, are oily floors, and floors littered with rubbish, scrap and raw material. One factory employing a thousand persons considered $10,000 a year spent in keeping the factory clean a good investment. The manager of this concern is of the opinion that safety and cleanliness are analogous. This concern prides itself on the fact that not one of the men has incurred a puncture wound to feet in the past five years. The projecting nail hazard in this factory has been entirely eliminated, due to good factory housekeeping. A great percentage of those accidents which are attributed to carelessness are unquestionably due to poor factory housekeeping.

Obstructed or crowded aisles are prolific causes of accidents not only to truckers, but to employees whose work is situated near the aisles. In plants where machines are placed close together the accident rate is invariably higher than in those in which ample space is provided. Safety aisles should be laid out, with "dead lines." One aisle should be utilized for "Up Travel" and one for "Down Travel." Each truck should be equipped with a horn or bell to warn of its approach. Safety aisles should not be less than eight feet wide. The internal transportation of material presents a serious hazard.

Defective tools and appliances are always a source of injury to workers. Broken hammer handles, wrenches, chisel handles, screw drivers, mushroom headed hammers all contribute their quota to the accident list and are good illustrations of poor housekeeping.

Inadequate illumination rightly comes within the purview of poor housekeeping, and is responsible for an annual cost of nearly $300,000,000 due to accidents. As regards the immediate effect of lighting on output, the industrial commission of Wisconsin found that a steel plant, just by changing its system of lighting, could increase its output at night over ten per cent.

An English concern found that the efficiency of the workers gained from five to fifteen per cent. after the factory windows had been cleaned. Dark, dirty walls and ceiling do not reflect light; they absorb it.

Defective ventilation is also responsible for many industrial accidents, since extreme fatigue may be superinduced by poor ventilation.

Recently a survey was made by Dr. H. M. Vernon, of the British Industrial Fatigue Research Board, to determine the optimum temperature with regard to accident immunity. He found that accident frequency gradually increased with decreasing temperature, until at 52 degrees it was 35 per cent. greater than at 67 degrees. "At 47 degrees it was rather less than at 52 degrees, possibly because the workers reduced their rate of production and thereby ran less risk of accidents. At temperatures above 67 degrees the accident frequency increased rapidly, until at 77 degrees it was 30 per cent. greater than at 67 degrees. In all probability a temperature of 67 degrees is too high for the maximum efficiency of workers engaged on fairly active work."

A series of experiments conducted by the New York and

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Chicago Commissions on ventilation showed man's greatest efficiency is between 60 and 68 degrees Fahr.

The customary figure of 70 degrees Fahr. for the atmosphere in even ordinary occupations, in which there is little physical activity, has been experimentally demonstrated to be physiologically harmful.

To reduce the temperature to 60 degrees in shops and offices would do much to cut the high cost of living by saving in coal and increasing the workers' output, and lessening sickness. Practically no discomfort will be experienced in a room in which the temperature is 60 degrees, provided the humidity is kept around 50 degrees.

The New York Commission on Ventilation found that when they kept rabbits in a temperature ranging from 80 to 89 degrees, their resistance to disease was greatly lessened thereby.

The effect of hot and cold air on the lining membranes of the nose and throat was also investigated by this commission. They found that heat caused increased swelling, redness and secretion in the nasal membranes, which rendered a person more susceptible to colds.

Unquestionably, the prime requisite for lessening accidents is good housekeeping. Safety engineers generally agree that no more than 20 per cent. of the industrial accidents can be prevented by safety devices or any kind of mechanical equipment.

In plants where considerable guarding has already been done, the analysis of the accidents which still occur will show that they are the result of poor housekeeping.

A good illustration of poor housekeeping is the removal of guards from machines by workmen. A visit to any machine shop will show several machines, which have been guarded in conformity with State or Insurance requirements, but have been removed by workmen.

Grinding wheels are a constant source of danger. The hazard of bursting grinding wheels has long been recognized. Effective guards have been designed to minimize the effects of broken wheels; glass shields have been placed over the wheels to protect the worker's eyes from flying sparks. These guards are of no value unless they are in place, and one of the functions of good housekeeping is to see that they are not removed.

One industrial manager has found good housekeeping so productive of good results he has what is known as "Inspection Day," twice a year. During "Inspection Day," the families of the employees are invited to visit the plant and inspect the working conditions, under which the member of the family is working. They are permitted to roam around the factory and grounds, and inspect every nook and corner. After the inspection, motion pictures are shown and refreshments served. Inspection Day has done much to stimulate and sustain interest in good shop housekeeping, and as a result has accomplished a great deal of good in this shop. It has done much to cement good relations between the factory and the family of the employee.

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MICHIGAN

Economies at Michigan Smelter

At the Michigan smelter, owned jointly by the Copper Range Consolidated and Mohawk-Wolverine companies, a saving of 30 per cent in fuel consumption is being effected by means of its coal-pulverizing plant, which has proved a marked success. A further saving in costs has been effected by doing away with cupola furnace operations, the percentage of copper in the slag being too low to warrant re-treatment. Arsenic, formerly wasted, is being recovered from the slag and converted into a paste to be marketed as an insecticide, which is particularly effective in ridding the farms of grasshoppers and other insect pests.

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Speeding the Family Wash

(Continued from page 19)

washables and then ironing them. Most of that string of epithets apply even when the job is done by electricity, laundress or just plain washerwoman.

Against the background of a lifetime of blue Mondays it looks all wrong, like a scene from Alice in Wonderland, to see men and girls at work in the Pilgrim Laundry of Brooklyn, N. Y., whose selves and surroundings look as though they might be baking cakes or making candy, and be told they are doing not one, but a hundred family washings at a time! Spotless white overall uniforms, well groomed heads, hands and feet, daylight everywhere, no slippery, sloppery floors, no steam clouds! More women ought to see the modern laundry. And more women's husbands ought to see it, too.

This is not going to be a tedious description of how a laundry sorts and washes clothes, but just of the exceptional way in which the Pilgrim Laundry handles them, moves them from place to place, from operation to operation, from floor to floor. The conveying system in this plant is said to be the largest and most complete in any laundry of the country. So much of a pioneer is it that parts of it had to be built experimentally and the rebuilt after a trial. The laundry managers and the conveying engineers are studying its operation with a view to improving its performance of present duty and to still further "conveyorizing" the plant when certain enlargements under construction shall have been completed.

Very little man-power carrying seems left to eliminate. The bags brought in by the drivers, each containing a customer's wash, are dropped from the wagons into canvas trucks which are pushed by hand perhaps 25 feet to the elevator and from there, on the third floor, are again pushed by hand a distance of about 35 feet to the point where the bags are opened for classifying their contents. Thereafter practically all movement from one operation to the next is by conveyor.

The variety of the conveying mechanisms, their locations and their combinations, is interesting and ingenious in the highest degree. There are belts whose movements in both directions are utilized. There are gravity rollers and gravity slides. There are power conveyors that carry horizontally, vertically and on an incline. There are light, straight wire lines, like the cash carriers in stores, used to shoot tags and tickets where they will meet the work at the wrapping tables. They stand on the floor, they hang from the ceiling, and slides and spirals go through one floor to the next.

At one point a neat problem in planes and directions is solved by an over-and-under, over-again - and - under - again arrangement, just as the engineers who built the Hudson Tubes, where there must needs



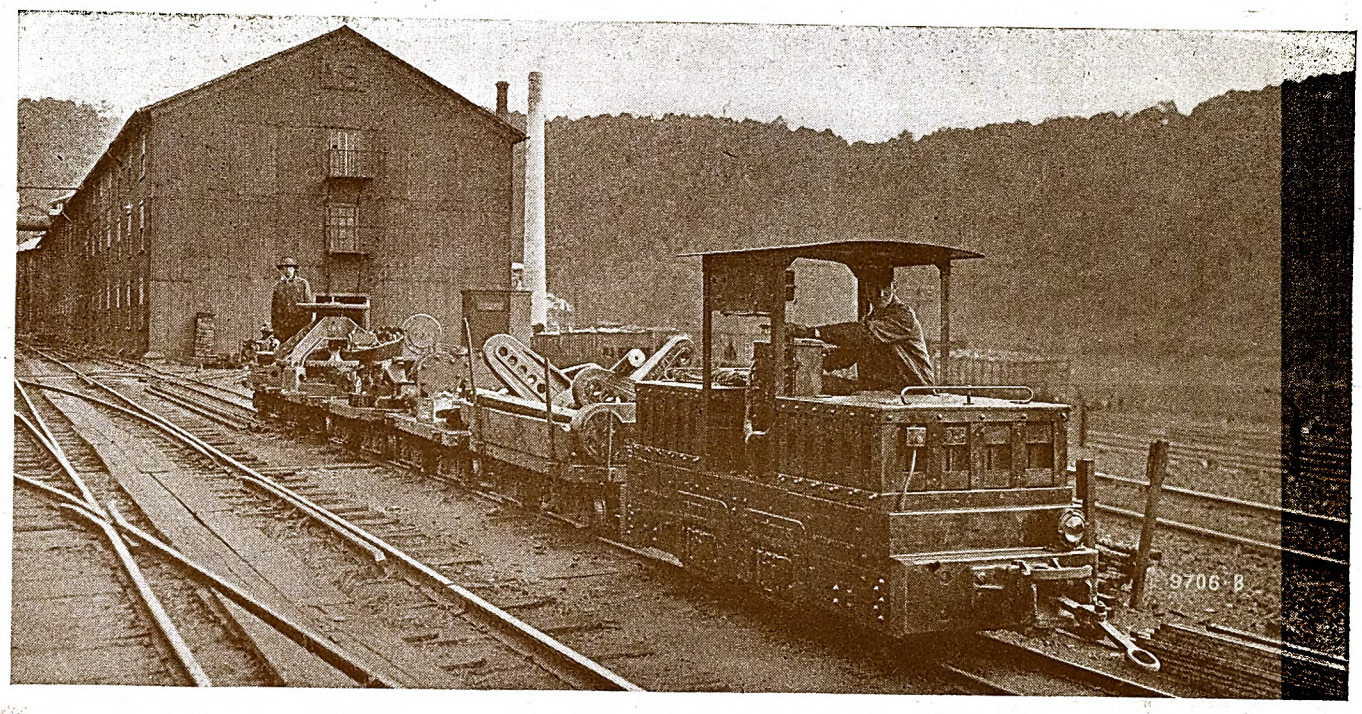
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be several complicated crossings in Jersey City, avoided making them at grade by entwining the tubes over and under each other like gigantic twisted lines of fire hose.

Do not get the idea that there is confusion in this varivet. The conveyors are not in the way of any worker or machine. The workers do not have to do any thinking or selection in using them. They constitute a circulating system and the variety is its adaptation to the work at each point, the operation to be performed just there, and the movement of the work to the next in line. The net result is that everybody's work is at his elbow as fast as he is ready for it, at the most convenient height and distance to save fatigue, confusion and loss of time without crowding on high speed. And when the operation is over, passing the work on to the next worker requires no more effort or loss of time than picking it up did. For example, the criss-crossing spoken of a minute ago could have been avoided by having half the apparatus at a height which would give a sufficient slope for all-gravity movement. In fact, at first it was constructed in that manner. But that necessitated an overhead lift on the part of the girls working at that point, so, on account of the human element, down they came to 12 or 14 inches from the floor, even though the engineers had to tie knots in the long lines of rollers and insert an inclined power section to get the load up to the high level.

In laundries not equipped with such complete mechanical circulation, each lot of clothes after each operation must be dropped into a truck. Each truckload must then be pushed along the floor to the next operation either by one of the operatives or by a 'porter. That movement, winding in and out among the machinery, necessarily must be slow, and the lanes which must be left open for trucking take up much floor space. Every time there is an obstruction in those lanes, trucking is stopped or at least retarded and, in turn, workers and machines are held up. Conveyors move at a constant, predetermined speed, timed so that work neither piles up at one point, nor is tardy in reaching other points so as to cause idle minutes there. Floor space occupied by the conveyor is but a little over half the width of a truck, just wide enough for a single bundle or lot, since they are instantly carried along out of the way as they are dropped on. Nobody ever leaves an obstruction on a conveyor to get in the way of its movement. There is no stooping and lifting as is required to load and unload a truck. And there is no waiting or calling to a possibly sick, temperamental or absent porter, to hurry up.

Apart from time, space and labor saving on specific operations, the outstanding advantage of conveyorizing comes from the operation of the system as a whole. This is its synchronizing effect upon all operations. It results in smooth working of the lot system whereby the several classifications of each customer's laundry, each receiving different suitable treatment, arrive at the assembling point in the shipping room so nearly together that confusion, errors and piling up of incomplete outgoing lots are minimized.



Move Materials Quickly and at Low Cost

HOW to move materials in the least time and at least expense—is a big problem around many industrial plants—others have solved it by installing **Jeffrey Electric Locomotives.**

One industrial plant saved $8000.00 the first year with their Jeffrey Industrial Locomotives—a few cents saved on every ton hauled in your plant would add up a large total in your yearly saving—wouldn't it?

Jeffrey Electric Locomotives—both storage battery and trolley type, are rugged in construction, embody latest successful engineers' practices, and move their loads at exceedingly low cost regardless of severe service or weather conditions.

No smoke, gas, dirt or soot to contend with—they consume power only when in actual operation—no skilled labor is required to operate.

Advise us about your local conditions, material to be hauled, amount of trackage planned, etc. and our experienced engineers will gladly suggest the most suitable type and capacity of locomotives to meet your requirements.

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Combining a Water-Supply and Power Development

(*Continued from page 21*)

pushed along with energy and speed. It is said that for many years to come the demand for power will keep pace with new sources of supply.

It will be desirable, in order to get a clear view of the power development, to have before us a fair understanding of the general enterprise.

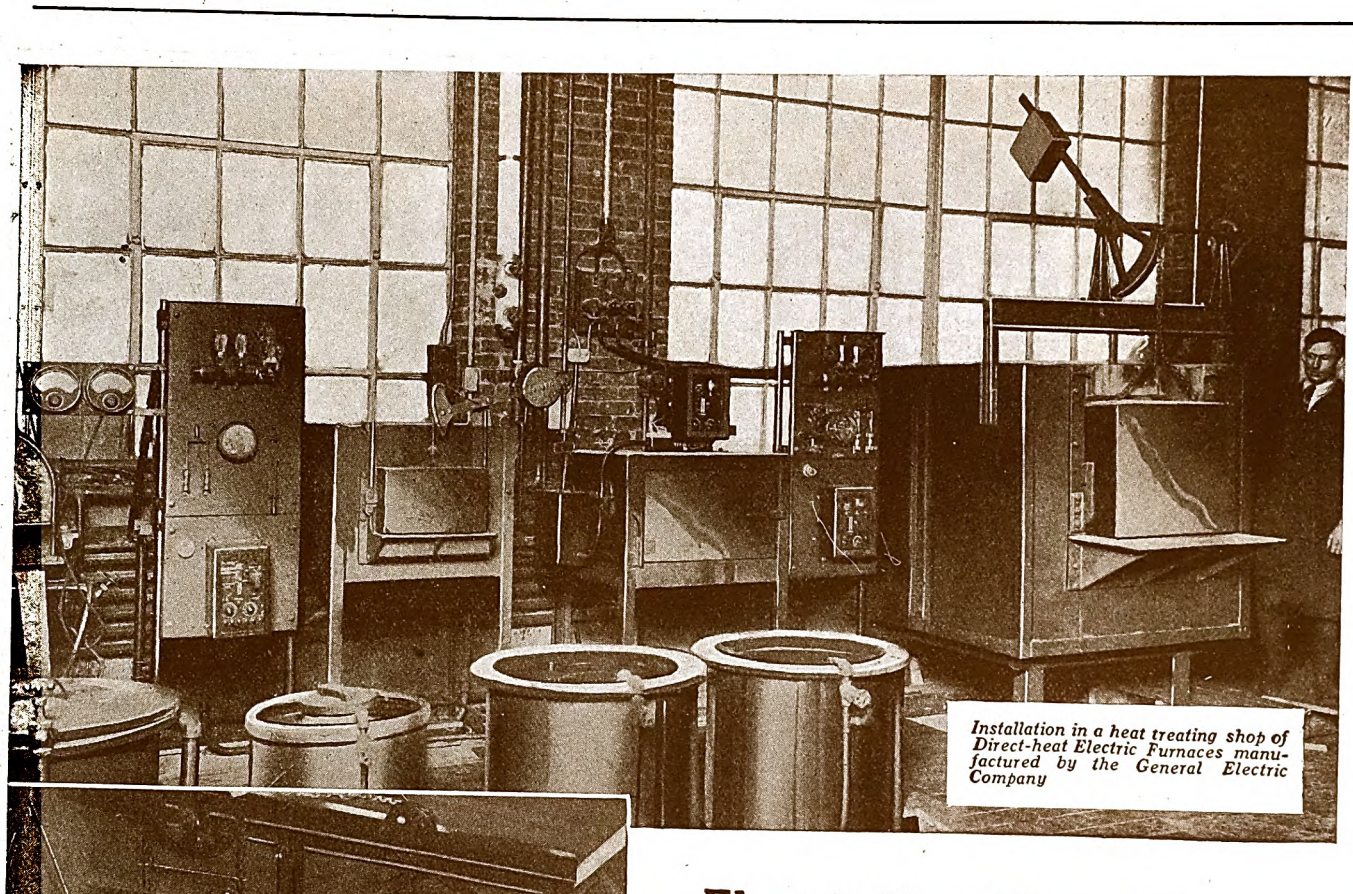
The Hetch-Hetchy Water Supply Project is expected to be competent to the needs of San Francisco and the adjacent metropolitan district for the century ahead. In so far as water is concerned. The capacity of 400,000,000 gallons per day covers this matter. In addition, there is to be a power development of something like 250,000 horse-power. The hydro-electric feature is an incidental of the main project. But, for the immediate future, it becomes the ranking element. The water for the great enterprise is to come from the Tuolumne River and some of its tributaries. The general location of the source of supply is 150 miles from San Francisco high up on the western slope of the Sierra Nevada Mountains. The chief site for reservoir use is in the Hetch-Hetchy alley. We have here the source of the name given to the project.

Ultimately, the great Hetch-Hetchy Dam will impound water, in the reservoir of similar name, to the enormous total of 113,000,000,000 gallons, enough to feed the aqueduct at capacity for one month. The watershed which will gather this water has an area of 459 square miles. Measured along the aqueduct route, the distance of this district from San Francisco is 170 miles. The level of the water in Hetch-Hetchy Reservoir which properly filled will be 3,800 feet.* Lake Eleanor is another reservoir on the distant slopes of the mountains. The watershed is not large, having an area of only 79 square miles. However, the reservoir capacity may be pushed up to 54,000,000,000 gallons.

Both the Hetch-Hetchy and the Lake Eleanor watersheds lie within the confines of the Yosemite National Park. But they are not within the Yosemite Valley itself. This wonderful valley is eighteen miles to the south-east of Hetch-Hetchy. It is in the drainage basin of the Merced River and is entirely unaffected by the water supply development with which we are occupied. Cherry Creek is a distant source of water whose valley lies in the Stanislaus National Park. It is to be made to deliver its water to Lake Eleanor. This is to be accomplished by means of a special aqueduct and tunnel. There are quite a number of small reservoirs in contemplation that I do not mention, but which may be developed later on as occasion occurs.

The flow line of Lake Eleanor, as this reservoir may

* This means 3800 feet above Hetch Hetchy Datum. To get U.S. C. & G. S. Datum, subtract 1.25 feet.



Installation in a heat treating shop of Direct-heat Electric Furnaces manufactured by the General Electric Company



Heat treating furnace equipped with G-E Direct-heat Units and Automatic Temperature Control.

Electric Heat Treating With G-E Equipment

The General Electric Company manufactures Direct-heat Electric Furnaces, complete in standard sizes, and Direct-heat Units to equip electric furnaces of larger sizes—meeting the requirements of heat treating processes of any nature in industry today.

The heating unit, located in the furnace chamber, radiates its heat directly to the charge. This produces rapid heating, and permits of quick changes in temperature when desired—and insures uniform temperature throughout the chamber.

This type of heating unit responds more quickly to automatic control, and operates at lower temperature for any given temperature in the furnace chamber, than any other type. It means long life to the furnace.

Quick, clean, accurately controlled heat that speeds production and reduces spoilage is essential to every heat treating process. You secure these advantages with G-E Direct-heat Uuits and Automatic Temperature Control.

G-E Industrial Heating Specialists will gladly help you work out a better heat treating furnace plan—through the proper application of electric heat.

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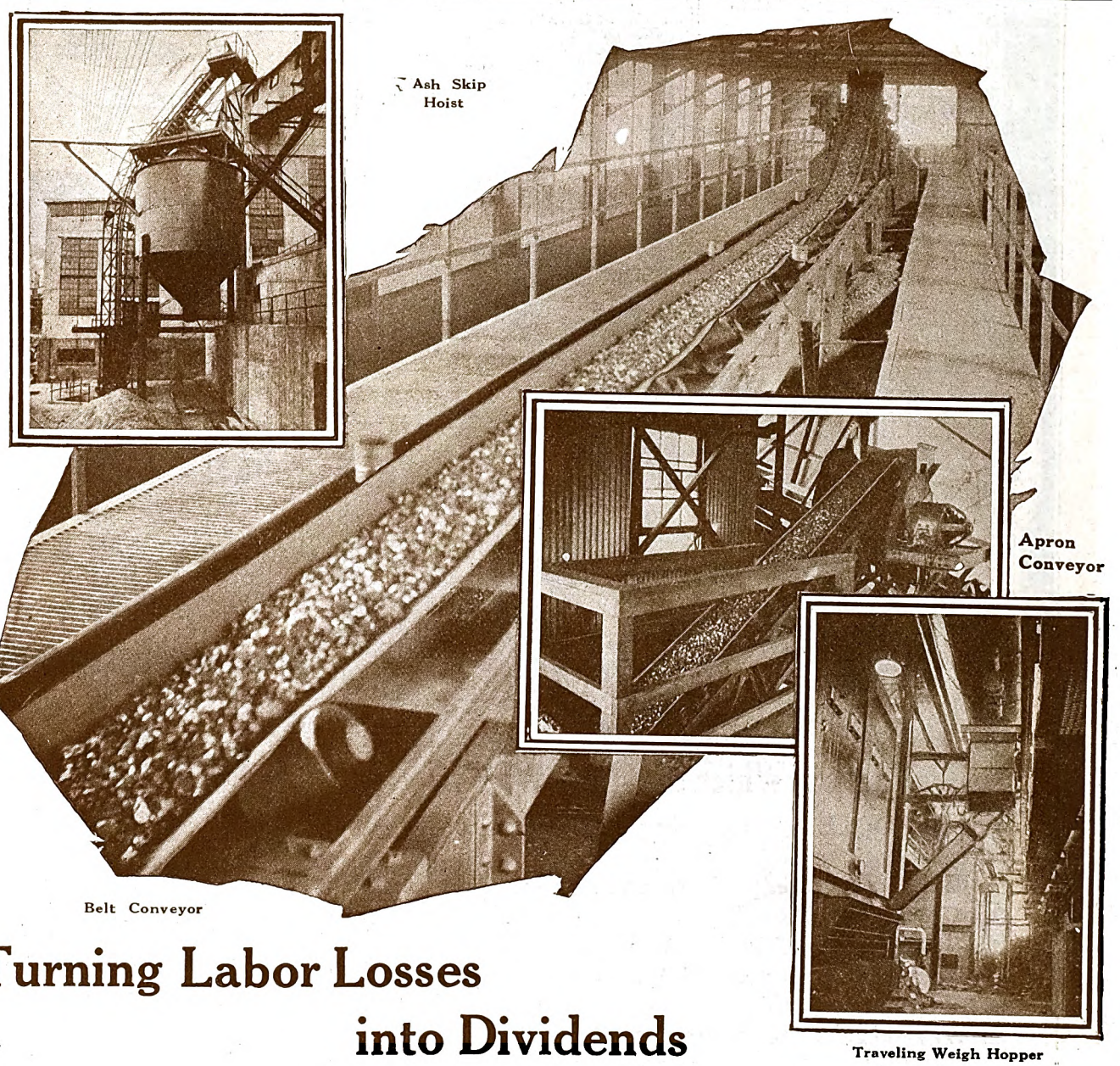
nt

be developed, will be one of the highest. That is, the surface will be at about Elevation 4715. This is an elevation suitable for a very respectable mountain. At least it would be so considered in the Eastern States. The watershed region that is to be tributary to the Hetch-Hetchy development has a total area of 652 square miles. Its elevation above the sea varies from 3,500 at Hetch-Hetchy to 13090 feet at Mt. Lyell. In fact, some 92 per cent. of the area is above the 6,000-foot level. No permanent habitations are located within the region and there are sanitary regulations which control the contamination of the water by parties camping in the summer time. In short, San Francisco and the vicinity have in prospect, it would seem, an abundant supply of very pure mountain water.

One of the chief construction features of the great enterprise is Hetch-Hetchy Dam. Ultimately, the height above stream level is to be 312 feet. The plans now being carried out, which have in view the rapid development of hydro-electric power at this point, will be satisfied with an initial height of 226 feet. That reduced height will nevertheless develop a capacity of about 66,000,000,000 gallons. This will be, say, three-fifths of the ultimate possibilities of storage. A considerable lake will be brought into existence one having a length of 7½ miles and an avérage width of one-third of a mile. At the maximum breadth, the width will be double the average. There will thus be a new sheet of water in this district with a surface area of 2½ square miles. The ultimate development will not add greatly to the figures as to the lake, the increased capacity arising mostly from the added depth. Hetch-Hetchy Dam will at the beginning have a length along the crest of 600 feet. Ultimately, this dimension will be increased to 900 feet. The amount of concrete masonry in the dam when initially completed will be 400,000 cubic yards. Later, an addition bringing the total up to 660,000 cubic yards is to be made. The dimensions of Hetch-Hetchy dam, both for the initial structure and for the ultimate work, are such as to make it a very notable example of concrete construction carried out on an elevated site.

The dam is to have what is known as a gravity section. That is, it will be given a varying thickness increasing with the depth, and consequently the horizontal thrust, of the water. A plan view of the dam would disclose an arch, the concave side being downstream. The dam will accordingly resist the thrust of the water on the upstream side both by its weight and by the arch action due to its form. The use of arched dams has become common in recent years. In fact, if the canyon is wide, what is known as a multiple-arch dam may often be constructed. The structure at Lake Eleanor, which is nearly or perhaps entirely completed, is of the multiple-arch variety. However, with a plurality of arches, the upstream faces are inclined to the vertical, the inclination being directed downstream as one views them from below up. The mode of con-

(*Continued on page 75*)



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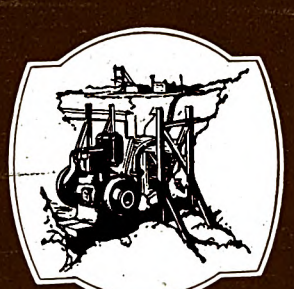
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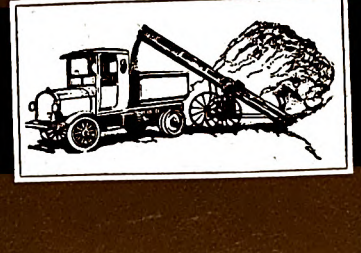
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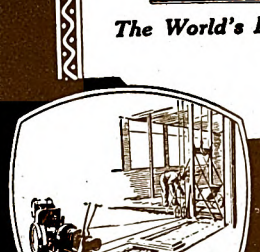
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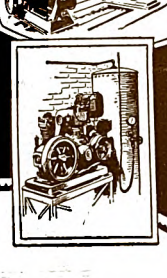
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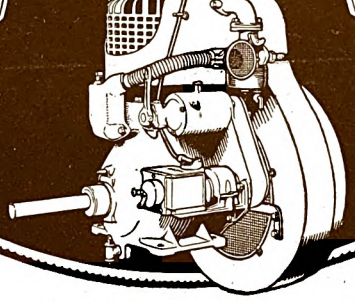














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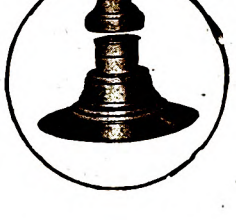
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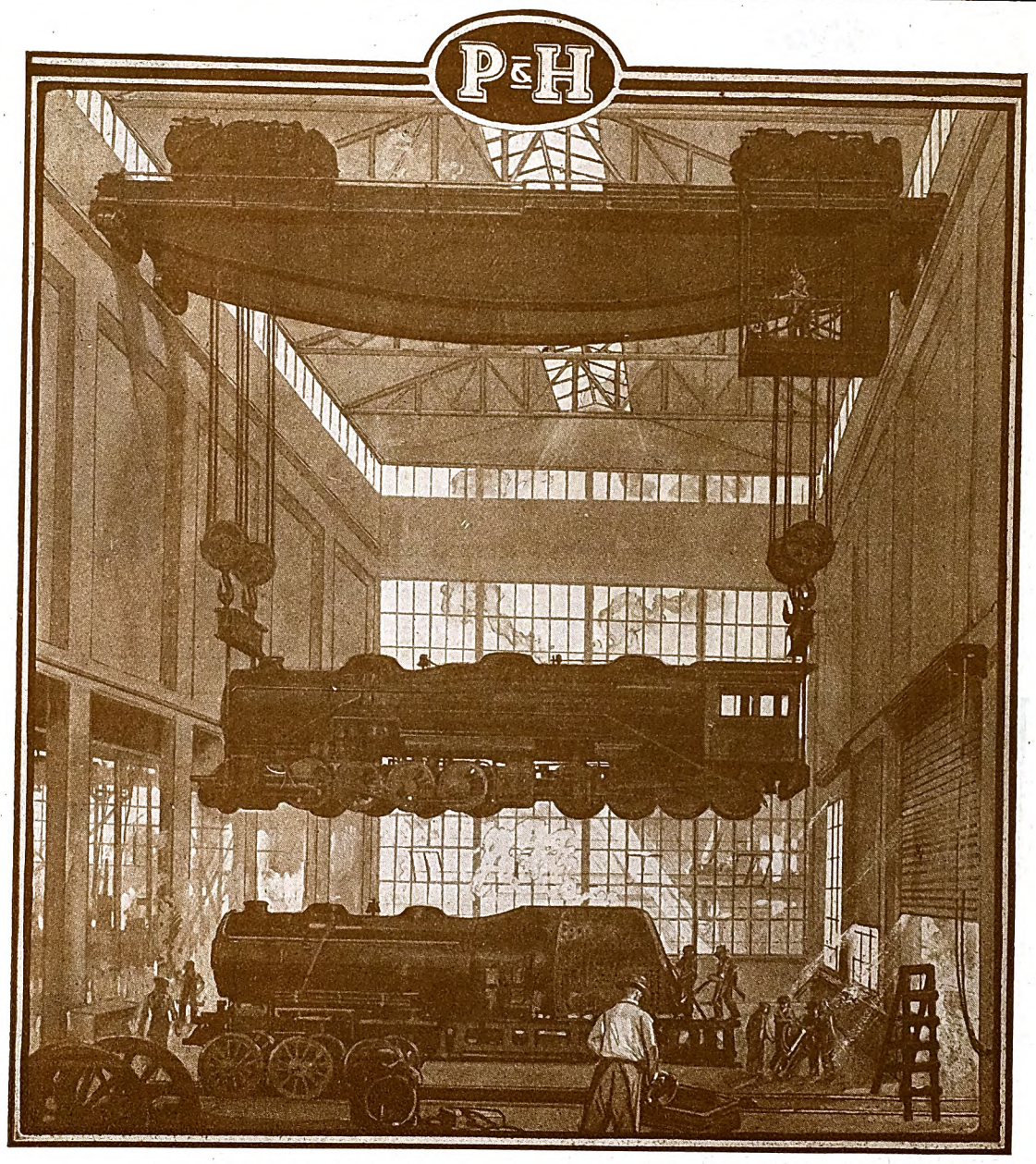
(*Continued from page 73*)

struction enables many dams to be built with less concrete than if a gravity section were employed in the design. The reason underlying this economy of material centers on the fact that the tilt enables the arches to transfer the thrust of the water to the foundation of the dam. At Hetch- Hetchy, however, the arch is a single one and the upstream face is vertical as well as convex. The foundation is naturally the bedrock. The lowest point is at elevation 3382.5 and the maximum thickness of the concrete dam put upon it is 310 feet. The initial dam will rise 344 feet above the lowest point and will accordingly not be so much higher than it is thick at the maximum point. When the dam is, later on, brought to its full height, no addition to the great bottom mass next the rock will be required. That is, the full body of concrete up to the stream-bed level (El. 3500) will be put in place at the beginning. When the dam is to be continued on up to its full height, the section will be added to on the down-stream face and the concrete above the initial crest will, on the upstream vertical face, be in line with the initial structure.

Ultimately, Lake Eleanor will be outranked in the present enterprise only by Hetch-Hetchy Reservoir itself. A part of the necessary dam has already been constructed. This will form the toe of the structure that is to be eventually built. That is to say, the present dam is of quite moderate height, but later on this structure will be added to and the height and base increased. It was desirable to use a design permitting rapidity of construction for the initial dam, and at the same time avoid any considerable transportation of material. These considerations weighed in the selection of the multiple-arch type of dam. The single arch type was out of the question. The dam constructed has 20 arches each of 40 feet span. They constitute the multiple arch dam proper. Then there is a total of 460 feet of gravity wall, 200 feet being spillway. There is a log chute in the gravity section of the dam, through which logs may be passed to the lower level. The upstream face of the multiple-arch section presents a most unusual view. Here are twenty big cylindrical surfaces leaning over in the direction of flow at an angle of 50° to the horizontal. A notable detail consists in the fact that the barrel of the individual arches is not a circular cylinder. It is the horizontal section whose outline presents a circle and not the section perpendicular to the axis. The great stretch of "leaning towers" are individually surmounted by vertical faces seven feet high.

The Hetch-Hetchy Dam impounds an extensive body of water, as has already been pointed out. In accordance with the plans for the initial development, the water released from this great reservoir will flow down the mountain sides for a distance of twelve miles and will utilize the natural channel of the Tuolumne River. The change in level accomplished by the river in this distance is 1,160 feet. Later on, this drop is to be developed into electric en-

(*Continued on page 77*)



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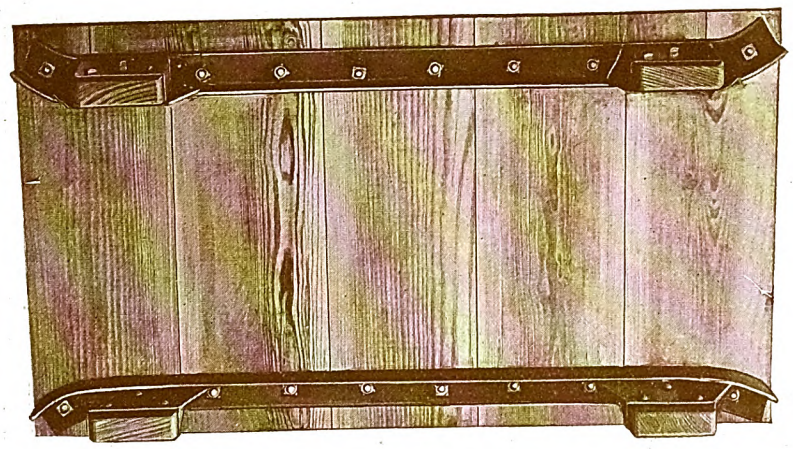
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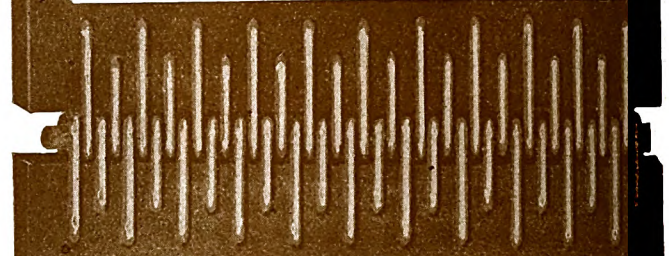
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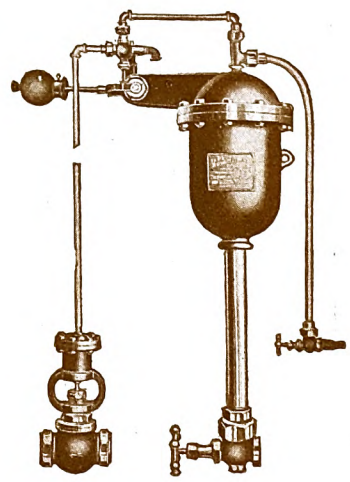
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(*Continued from page 75*)

ergy. That is to say, a tunnel aqueduct is to be constructed in the granite wall of the canyon on the southern side of the river and, in connection with this constructional feature, the hydraulic drop will be utilized. At first, however, the water from the Hetch-Hetchy Reservoir will flow through the twelve-mile natural channel to a diversion dam at Early Intake.

The portion of the aqueduct that is now being built begins at Early Intake. A canal one-half mile long leads from the diversion dam and provides a group of settling chambers. Next, the aqueduct water will be led through a great tunnel 18.3 miles in length. Emerging from this tunnel, the water will flow into the regulating forebay at Priest.

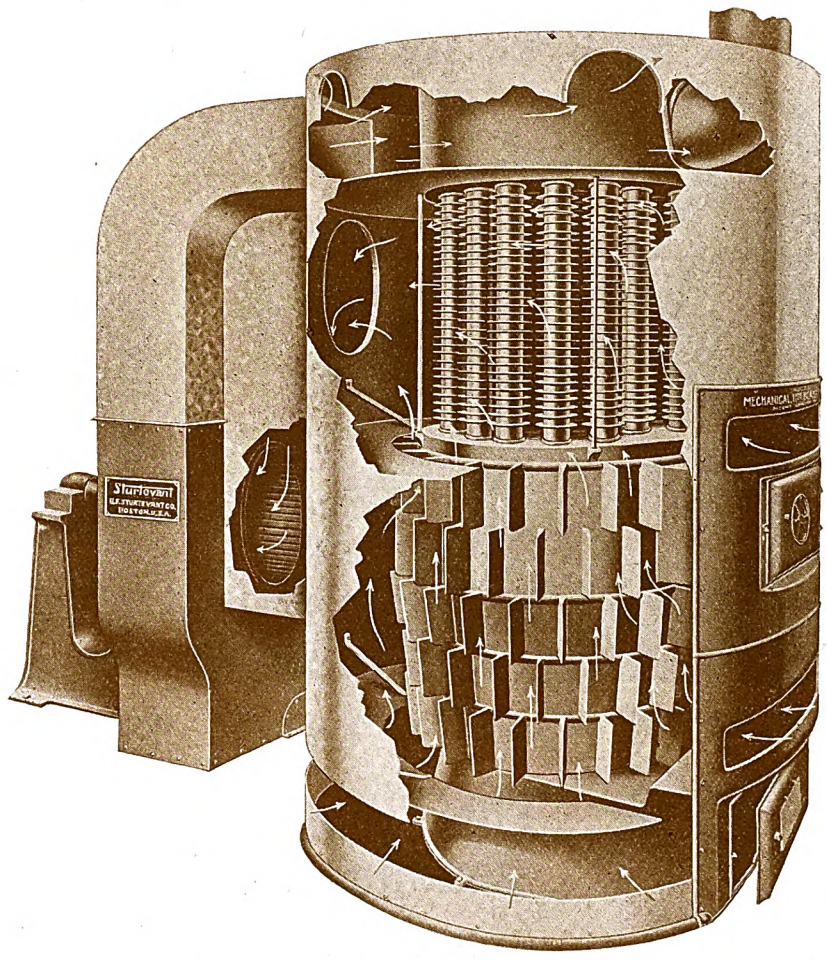
All the tunnels of the main aqueduct are so placed that they will be under a slight upward pressure from the contained water.

At Priest, a reservoir will receive the water brought by the aqueduct. It is expected that the incoming water will arrive at the constant rate of 400,000,000 gallons per day. This means 619 cubic feet per second. But the water will be utilized at varying rates, because the demands for power will naturally fluctuate from hour to hour. On the other hand, no extensive fluctuation in demand is apparently in contemplation, because the capacity of the reservoir as planned will be only the flow of two days. A small sheet of water will be created, whose cubic amount is estimated at 2,500 acre-feet—that is, the cubic content of a lake 1 foot deep covering an area of 2,500 acres. The power plant is to be built on Moccasin Creek near by. The dam impounding the water will be an earth and rock-fill structure with a height of 145 feet. A concrete core wall will be imbedded in the mass. There will be an outlet tunnel from this reservoir, which will conduct water through an adjoining ridge. This will have a length of perhaps one and one-third miles. At the end of this tunnel, the water will pass into steel pressure tubes which will convey the water to the power plant on Moccasin Creek. Each of the pressure pipe lines will be 4700 feet long.

The maximum hydrostatic head will be 1315 feet. This means the very considerable pressure of more than 1700 pounds per square inch at the base, neglecting frictional reductions. The power developed by the water-wheel and dynamo installations will naturally fluctuate with the demand. It is, however, estimated to amount to an average through the day of 70,000 horsepower. At the beginning there will be an installation of three generating units, each having a rating of 20,000 kva. These are to be driven by double-over-hung impulse water-wheels.

The forebay capacity for the Moccasin Creek hydroelectric plant is considered rather unusual. However, the other power plants of the system are so located that the topography of the adjacent country does not permit the construction of forebays. That is to say, these plants will operate steadily at 100 per cent. of their respective

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capacities. Moccasin Creek will have to take care of the entire fluctuation in the demand for power. Eventually, it is expected to entail at Moccasin Creek additional generating units for the purpose of providing for the peak loads that are to be expected.

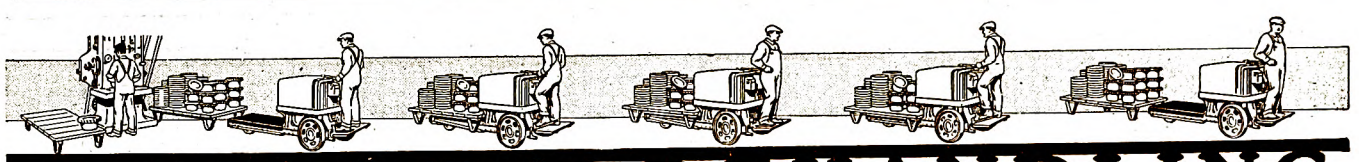
The water flowing through the Moccasin Creek Power Plant will naturally be water that is destined for water supply purposes at San Francisco and perhaps adjacent centers of population. But it will not be needed for this purpose at once. Enough water for the immediate future will be furnished from the Spring Valley water supply. When the time approaches to conduct Hetch-Hetchy water to San Francisco and vicinity, it will be necessary to construct the aqueduct west from Moccasin Creek. In the meantime the Hetch-Hetchy water will be serving mankind with power in the form of electric current. However, the water is good for power purposes and also for the ordinary uses to which water is put. That is to say, water from high elevations may be made to generate power as a by-product while it is flowing on to serve the cities in the lowlands.

When Hetch-Hetchy water is wanted for water supply purposes, the beginning point of the necessary aqueduct construction will be at the tail-race reservoir which receives spent water from the Moccasin Creek Power Plant at Elevation 900. This figure shows that the levels of the lower districts are being approached, although as a matter of fact the aqueduct route west of this point is really a large part of the total. The first part of this route will be occupied by a seventeen-mile tunnel to Oakdale Portal. This is a point in the foot-hills to the east of the San Joaquin Valley.

The foregoing tunnels with one exception are designed to carry 400,000,000 gallons of water per day. The exception is the tunnel leading from Priest Reservoir, which is to have still greater capacity, in order that excessive loss of head may be avoided when the Moccasin Creek Power Plant served by it has to take care of peak loads.

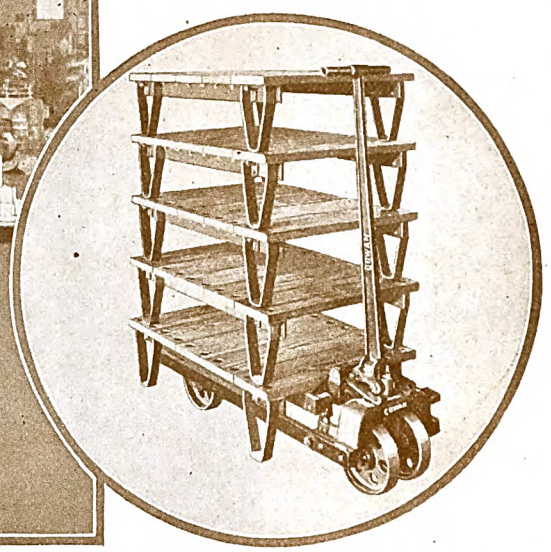
A long aqueduct is apt to pass through quite a variety of topography. It may in consequence be necessary to vary the type of construction used for the aqueduct in order to satisfy proper requirements in an economical manner. Thus, in the construction of the Catskill Aqueduct for the City of New York, the type of conduit varied from section to section. At one place the aqueduct would consist of a covered trough, no upward pressure of water calling for consideration. At another point, a pressure tunnel through the solid rock would form the aqueduct. And so on. At the crossings of valleys, it was frequently decided to use steel pipe lines. These constitute the standard means of carrying the aqueduct across valleys on the east side of the Hudson, south of the great crossing of the river from Storm King Mountain to Breakneck Mountain. A considerable advantage of the use of such inverted steel siphons consists in the readiness with which an initial installation of less than the ultimate may lat-

(Continued on page 80)



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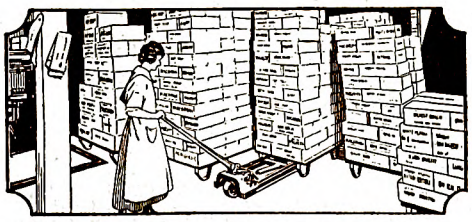
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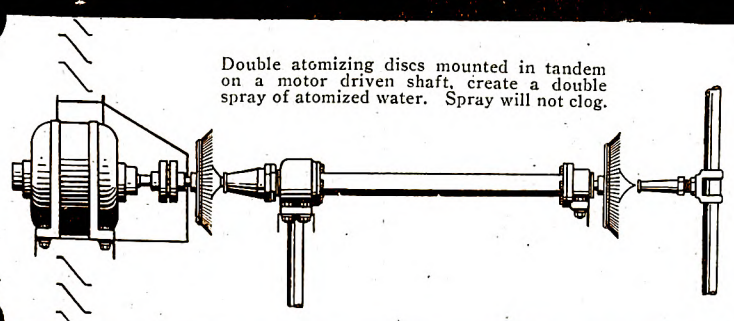
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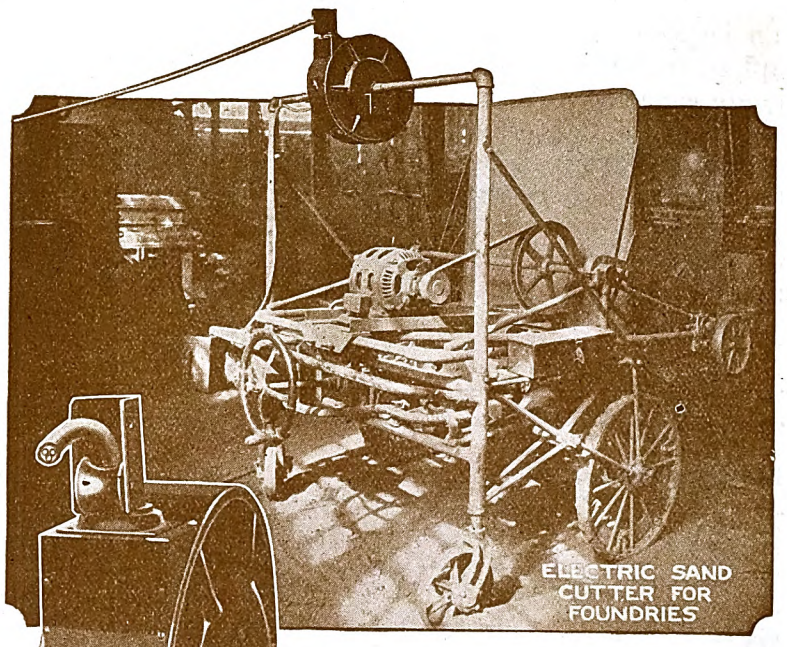
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(*Continued from page 78*)

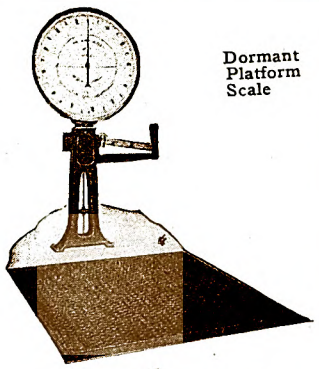
er on be converted into the complete installation of full, ultimate capacity. The valley crossings of the Catskill Aqueduct that I have referred to were designed to carry the ultimate amount of water in a triple system of tubes. At the beginning, however, only one tube was installed.

Now, at the San Joaquin Valley, the San Francisco Aqueduct will have a forty-five mile crossing from Oakdale Portal on the east to Tesla Portal on the west. It is expected that eventually three pipe lines will be installed, each with one-third of the total capacity of 400,000,000 gallons per day. It will be quite possible to put in at first a single pipe line, leaving the installation of the others to await the demands of the San Francisco Metropolitan district. It is calculated that for seven-tenths of the forty-five miles, these pipe lines will be under a pressure due to a head of from 450 to 540 feet—that is, to a pressure round 195 to 234 pounds per square inch.

West of the San Joaquin Valley, the Coast Range must be penetrated by the aqueduct. This will be a long tunnel 31 miles in length. At the west end, at Irvington Gate House, the aqueduct will be within about three miles of the waters of San Francisco Bay, although far to the south of San Francisco itself. Doubtless, it was desired to avoid a crossing of the Bay at points where the full width would be encountered.

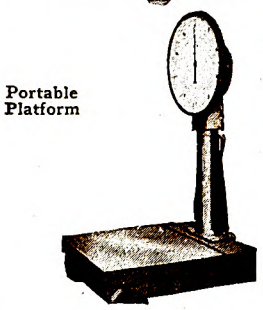
The aqueduct is to be divided at Irvington Gate House into three terminal sections. The principal section will continue westward, crossing a narrow portion of the Bay, and will swing north to San Francisco. The ultimate capacity of this portion is to be one-half of the total—200,000,000 gallons per day. Another section will serve the East Bay cities, and the third will extend south and supply San Jose. The San Francisco branch will, at the crossing of Alameda Creek, receive water from the Spring Valley System, which water will naturally mingle with that from Hetch-Hetchy.

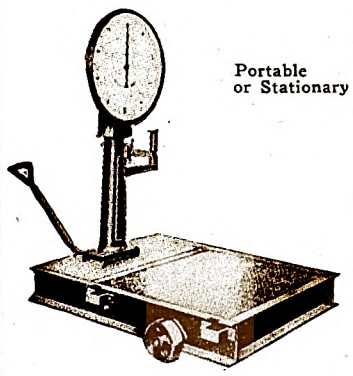
A good deal of pipe-line construction will be involved in completing the work after the penetration of the Coast Range. The advantages of this mode of construction that have already been pointed out will probably be kept prominently in mind, as everywhere economy is a great compelling cause. In connection with the aqueduct, as has already been intimated to some extent, it is proposed to utilize the Spring Valley Water System as far as possible, both in the avoidance of the duplication of construction and in the utilization of near-by water resources. But after all economies are taken into consideration, the ultimate cost of the Hetch-Hetchy project will be enormous. It is highly fortunate then that the enterprise is of such a character that a big hydroelectric development may be constructed in the early stages of the undertaking and made to produce a steady and increasing revenue. After the example afforded upon so large a scale, there will doubtless be many imitators.

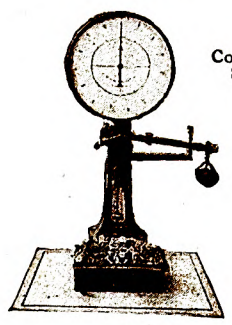




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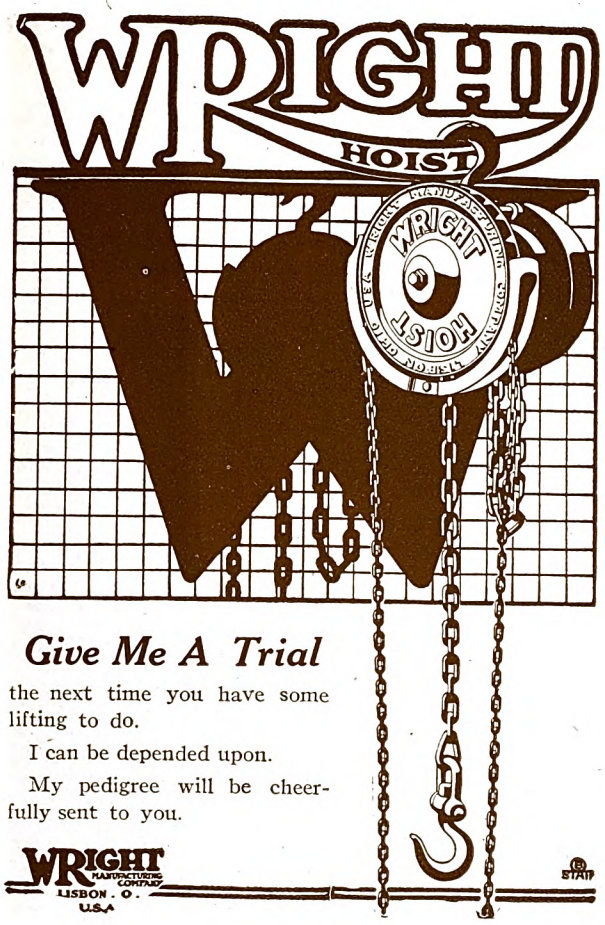
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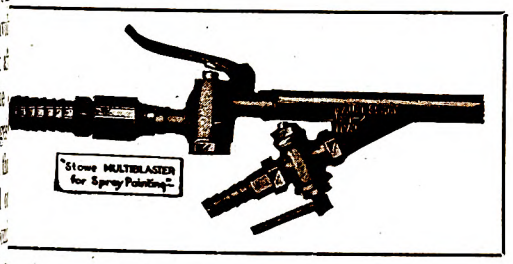
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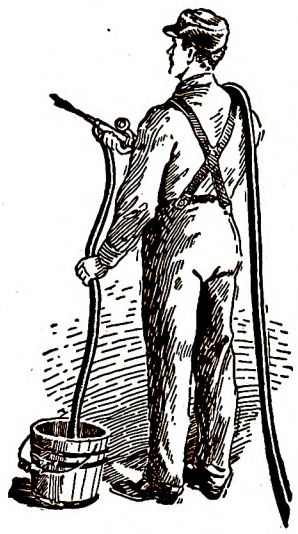
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Industry Illustrated

Men, Methods and Machinery of Modern Management

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Making the Equipment Fit the Job

(See Page 8)

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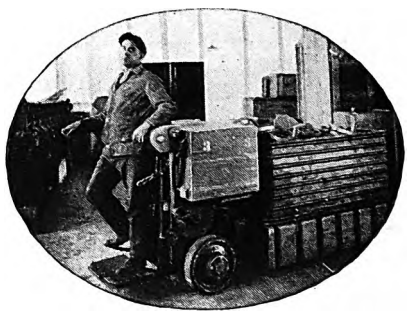
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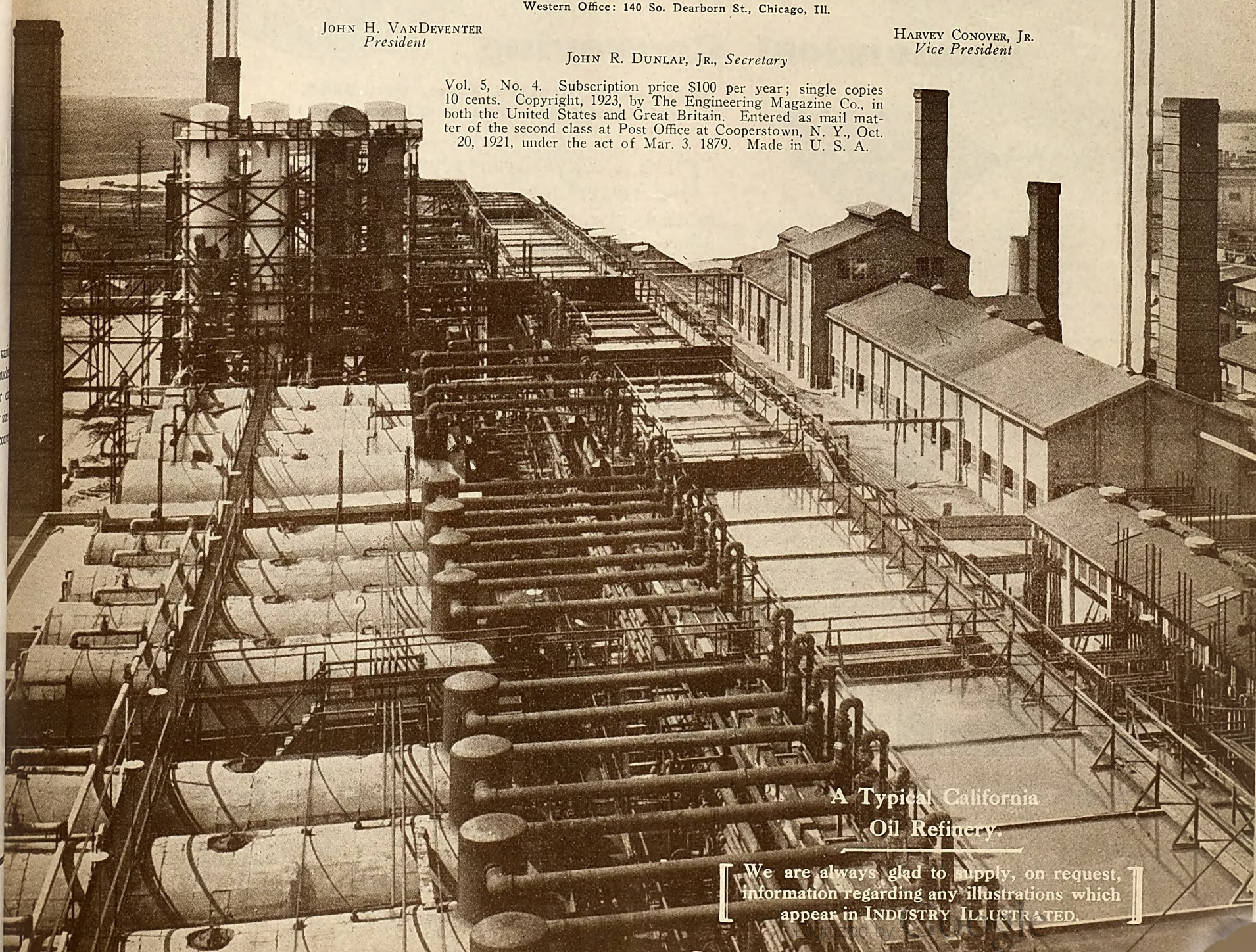
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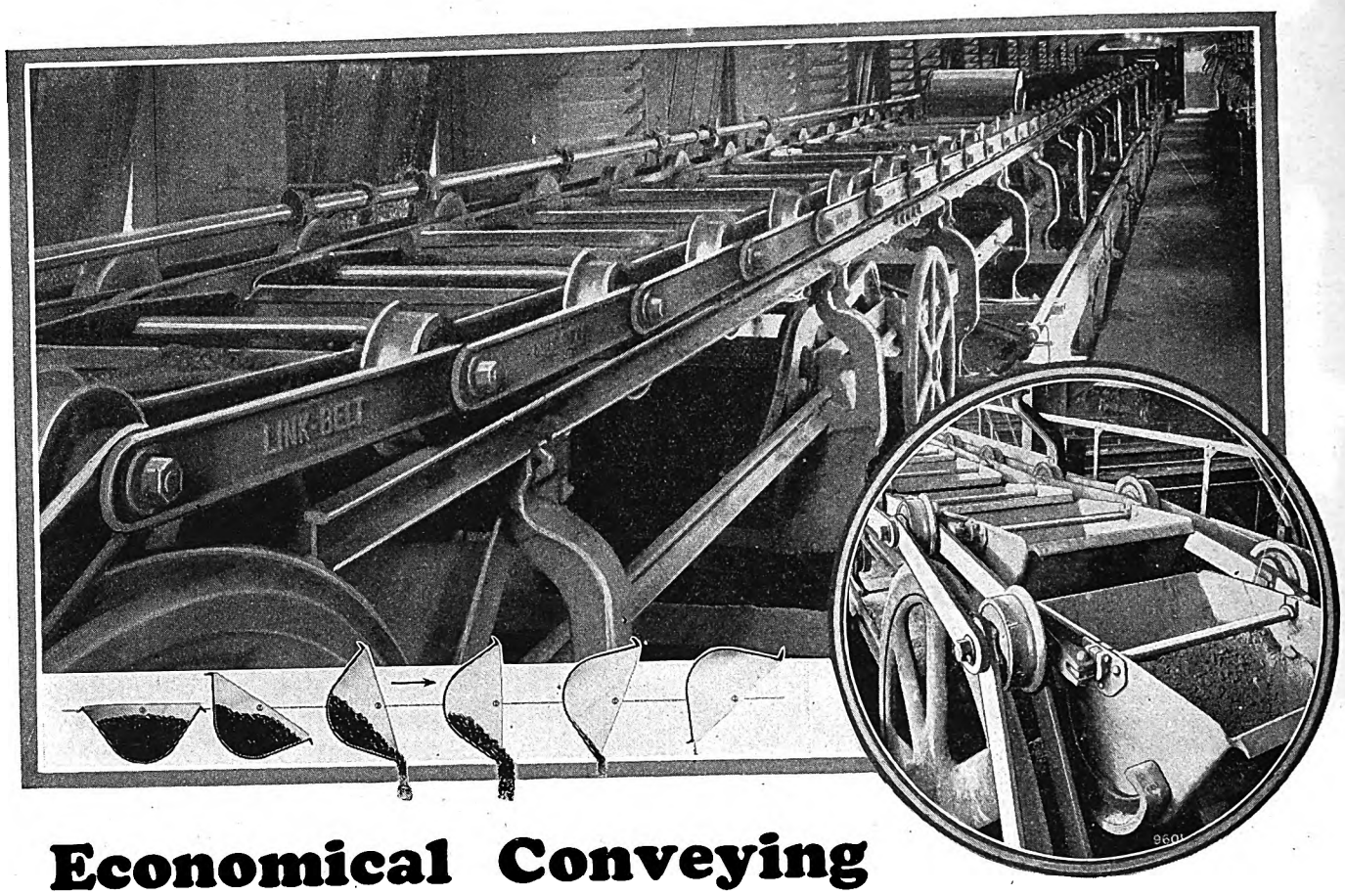
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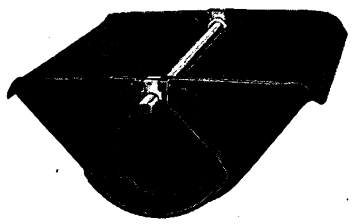
A Typical California Oil Refinery.

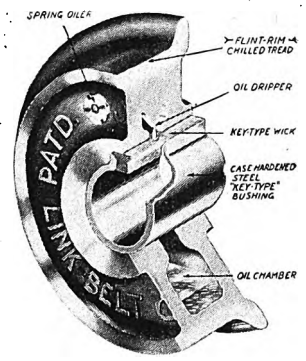
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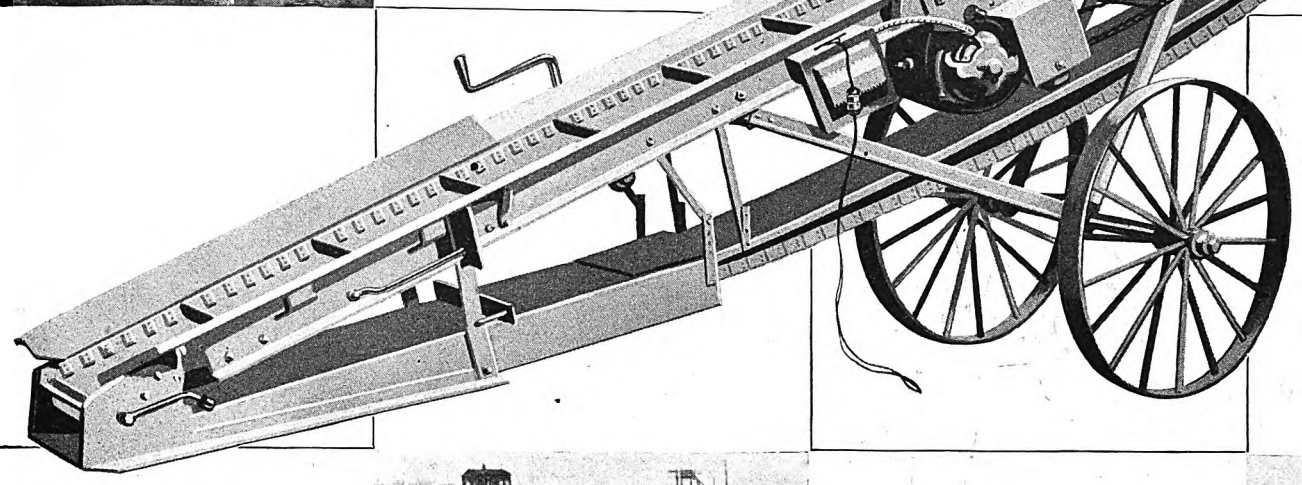
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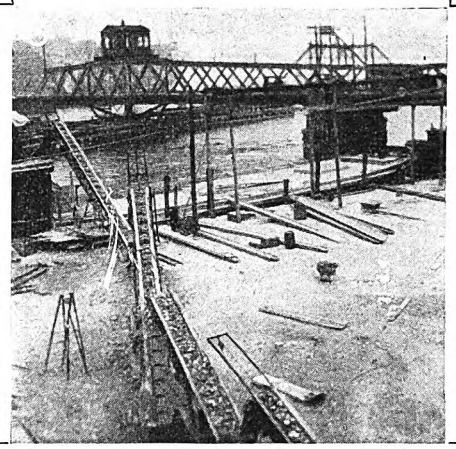
1—*REPLACING WHEELBARROWS. A Type U Loading brick from a kiln for the Onondaga Brick and Tile Co. at Onondaga, New York. It shortens wheelbarrow hauls in this case. In others, it does away entirely with wheelbarrow work.*



2—*UNLOADING CARS. A Barber-Greene Type U being used for "hauling out" coal by the Martin Lumber Company, Geneva, Illinois.*



U-Type-Barber-Greene Portable Conveyor, equipped with electric motor.



3—*LOADING FROM PILES. In this case, the material handled is oyster shell, and four Type U Barber-Greenes carry it from stock piles to barges. New Haven, Conn.*

4—*PIT WORK. A Type U handling gravel for Pierce and Piron, of Aurora, Ill.*



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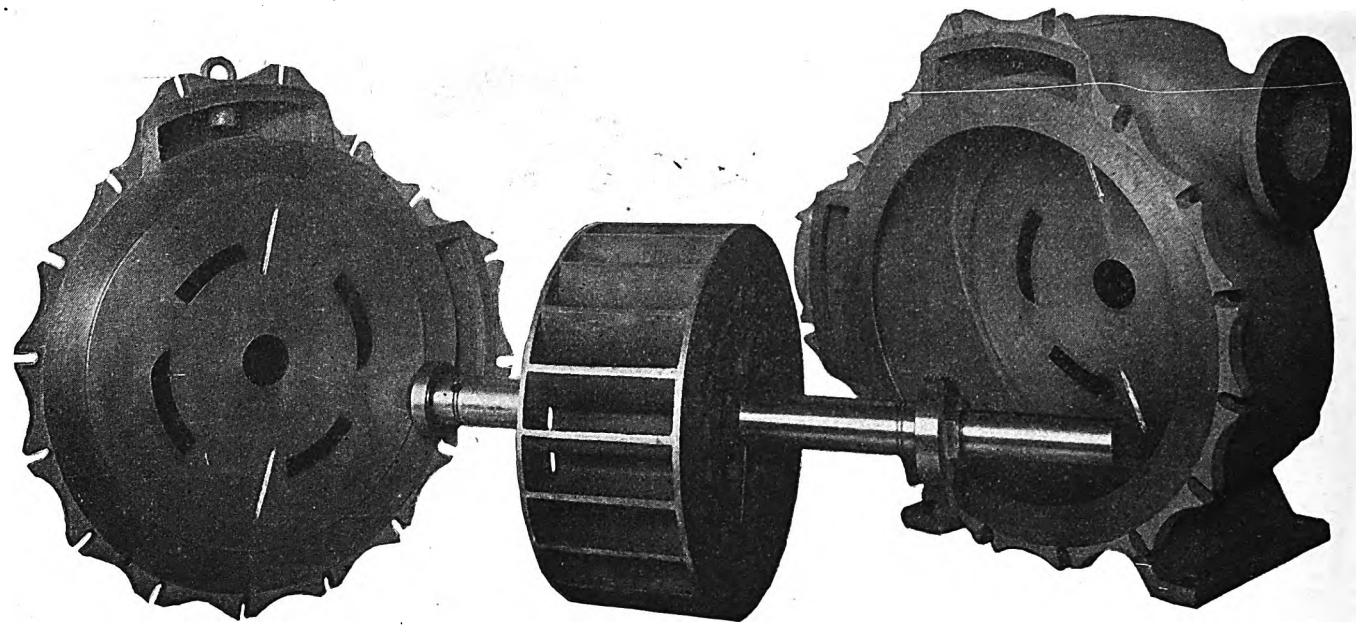
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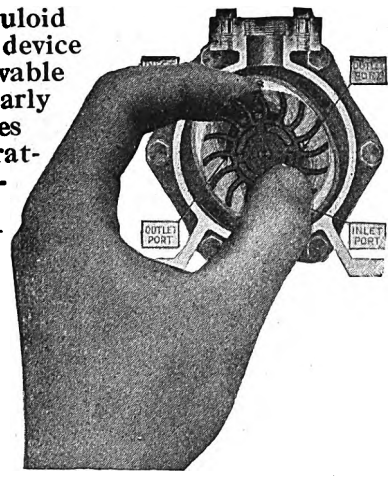
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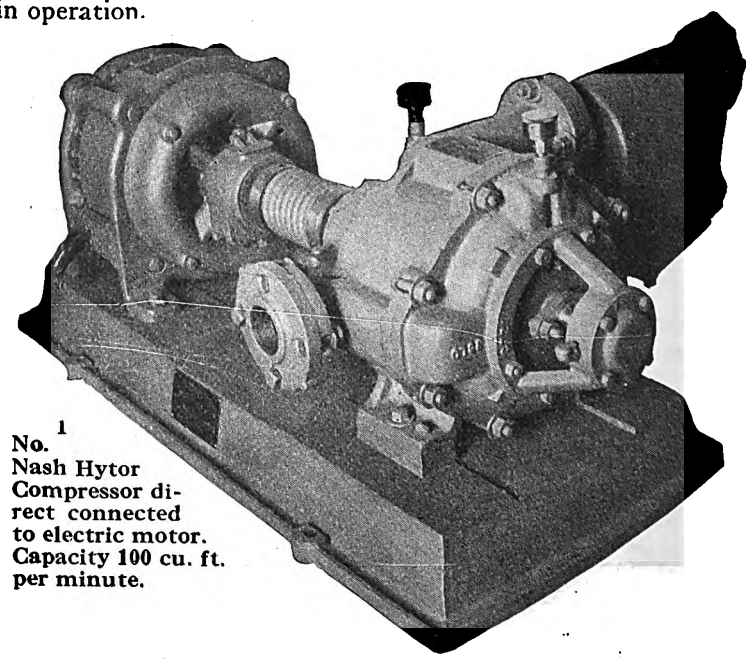
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EDITORIAL

What of the Next Two Years?

THE recently announced terms of settlement of the coal strike accomplish one thing: they give promise of a two-year period of uninterrupted production. All three of the parties interested in the dispute both win and lose. The miners win a wage increase but lose the check-off; the operators lose on the wage issue, but win on the check-off principle; the public wins as to continued availability of fuel, but—as usual—is to pay the costs in higher fuel prices.

So far as the agreement assures continued production, it is a success. But as a permanent settlement of the coal question, it is merely a postponement. Right on the heels of the agreement, we read the report of the Coal Fact Finding Commission—whose recommendations and analysis bear out the foregoing statement.

The march of evolution is exceedingly slow and often cumbersome, but it is relentlessly sure. All those things which we enjoy today, are the result of industrial evolution. And the progress of this evolution is determined always by our ability to reduce the net cost of production of these necessities and conveniences, thereby making them available to a greater number; in short, raising the average standard of living, and reducing the average of man's necessary labor.

It is from this standpoint that conditions in our coal industry are intolerable. Until recently, there was no known substitute for coal, and therefore conditions in that industry became somewhat analogous to conditions in an absolute monarchy. Even today, we probably could not do without coal entirely; but we have oil, and we have water power—both being developed as active competitors.

There was a time when a certain king of France gave voice to a famous phrase: "The State?—*I* am the State." And only yesterday, the attitude of the coal producers—"Power?—*Coal* is Power"—was justified. But the day of monopoly is following the day of absolute monarchs into the discard.

We are living in an age of industrial civilization—an age of competition. More than anything else, it is an age where cheap mechanical power is the one essential thing.

It lies within the power of those in the coal industry, to put the next two years to good use; to set about a house-cleaning which shall once for all put our greatest basic industry upon a common-sense basis. If they will take the initiative, and attack the problem fearlessly and without favor, it will be the greatest piece of constructive work accomplished in many years—and the present breathing spell will have been justified.

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Making the Equipment Fit the Job

Special Trucks That Eliminate the Back-Breaking Jobs

BY MATTHEW W. POTTS

A RECENT article appeared in this magazine, under the heading "Solving the Impossible," and called the readers' attention to the possibility of making many ingenious material handling devices from standard parts, and illustrated some of these conveyors and elevators which were now successfully performing mechanical operations that had always been considered as necessary evils to be performed by hand labor.

It is not difficult to obtain standard equipment for the majority of materials handling operations, but there are certain operations which standard equipment cannot be adapted to, and it is often impossible to change the method of operation. The manufacturers of materials handling equipment, and various engineers, however, have solved so many difficult problems that they now consider nothing impossible.

Some of the equipment which has been designed to meet particular transportation problems would come under the heading of special trucks, and are particularly known as tiering trucks, crane trucks, dump body trucks, furnace charging trucks, ram trucks, paper trucks, and special load-carrying trucks. These trucks were all primarily designed to meet some special need, and today several of them are almost considered as standard equipment, although further development is continually keeping them in the field of special equipment.



Fig. 1. The gasoline drive dump body truck shown does as much work as the 8 men with wheelbarrows in the handling of coal from storage pile to boiler house.

The only truck in the above classification that has been developed to such a point that is now considered standard, is the tiering truck. This type can be purchased in either gasolene or electric drive, and with various special attachments. Because of the fact that there are several manufacturers of these special trucks, there are on the market today, several different designs of tiering trucks, but all are using the same principle, namely; a cantilever platform travelling in a pair of uprights. The main difference is in the hoisting mechanism, and the location of the elevating motor drive and control.

Four different makes of tiering trucks are shown in figures 9, 10, 15 and 17. Special adaptations of the tiering principle are shown in figures 8 and 16, the latter not considered as standard equipment,

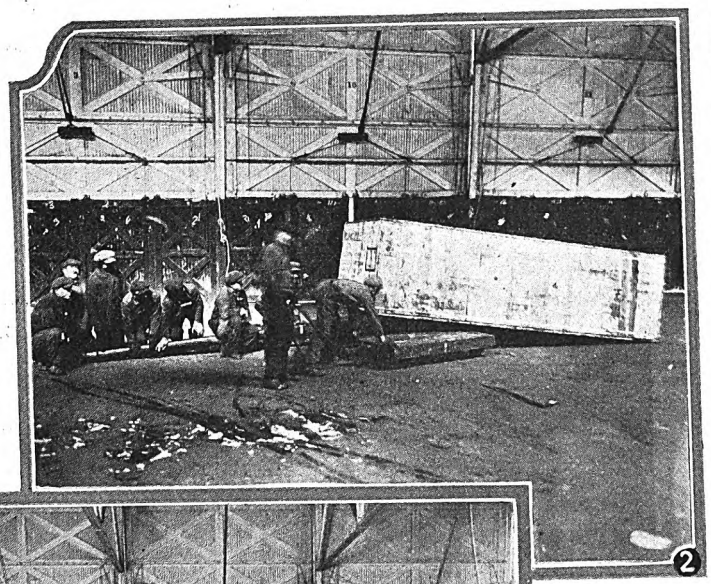


Fig. 2. When necessary to move automobiles packed for export, it required 9 pier laborers as shown to load them on to the hand truck.

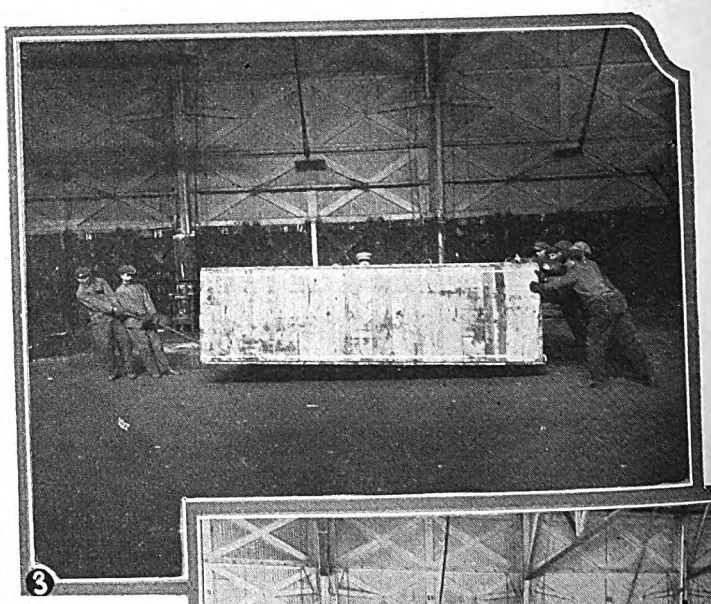


Fig. 3. This is a slow and expensive job. It requires 8 men to move the load after it is placed on the hand truck.

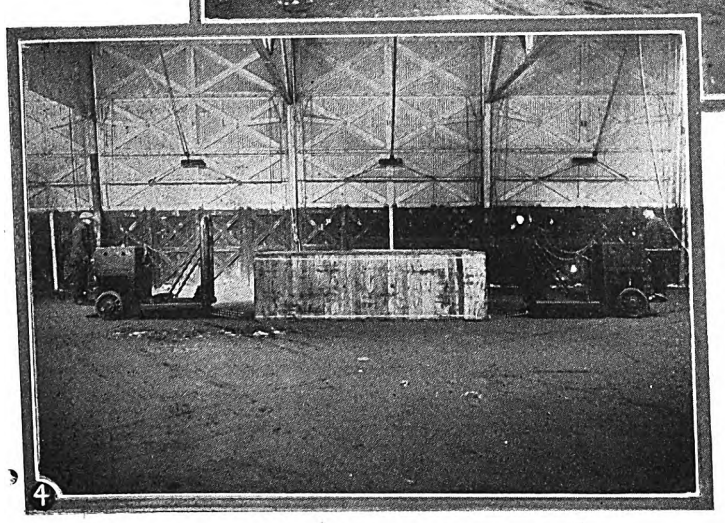


Fig. 4. This is the method now employed for moving automobiles on the piers. Note how the two electric storage battery finger trucks pick up the load.

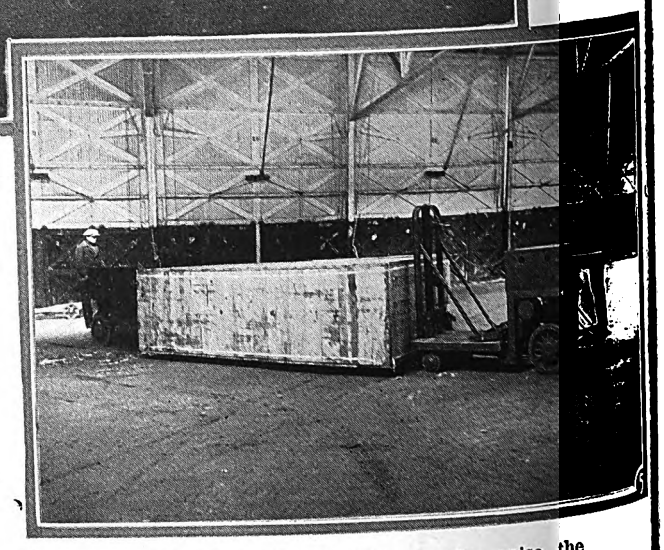


Fig. 5. The electric trucks raise the load and carry it suspended between them. This method of operation is much cheaper and quicker.

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Fig. 6. Piling material is expensive when hand labor is used. By using a tiering truck and placing one loaded skid on top of the other as shown, the work can be done more quickly and cheaply. This installation saved $100 per week.

but as special equipment to handle particular problems. These illustrations show how the same type of truck is treated in mechanical design by various manufacturers. Each manufacturer has also a trade name for the tiering truck which he produces. The same thing is true of all special design trucks, but there is no need of the executive becoming confused in making comparisons between different manufacturers, if he will look closely at the principle of operation, as well as the truck design and truck name.

Tiering trucks were primarily designed for the piling of materials, but after they were put into service, it was found that they could be used on a number of operations, such as loading motor trucks, (figure 14), freight cars, placing dies in punch presses, rais-

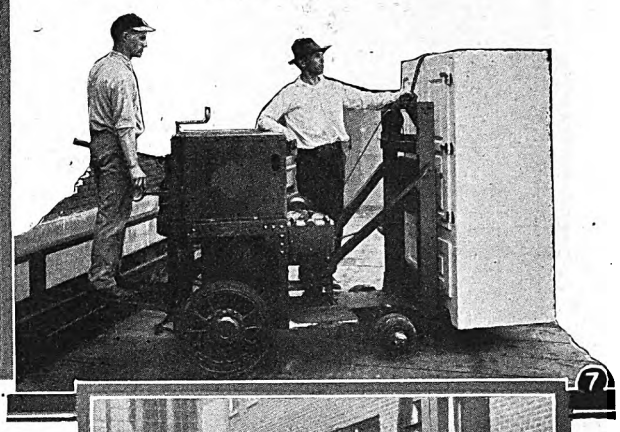


Fig. 7. Handling high grade refrigerators so as not to mar them is a problem. This type of lift truck moves them quickly and reduces rejects because of damage caused in handling.





Fig. 8. The tiering truck principle has many applications. Chemical plants find this platform attachment very advantageous. The arms are arranged to handle cyclindrical or square packages.

Fig. 9. These trucks not only transport the load, but greatly assist in piling it in warehouses, on piers, etc.

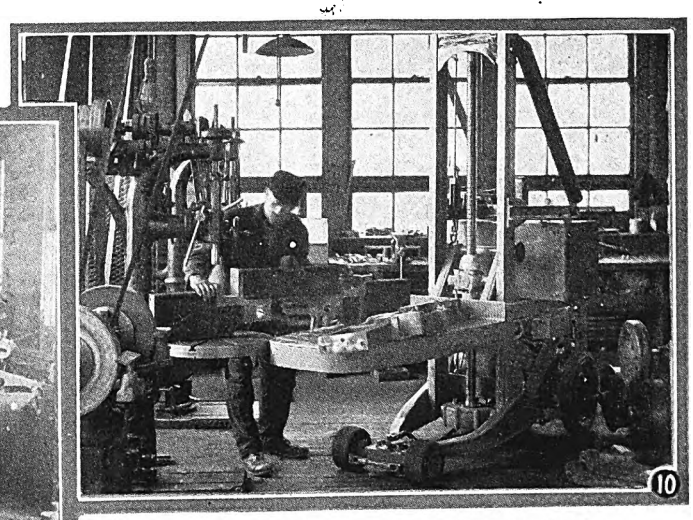


Fig. 10. Placing heavy casting in drill press and dies in punch presses is difficult if only man power is used. Materials handling equipment does it with ease.

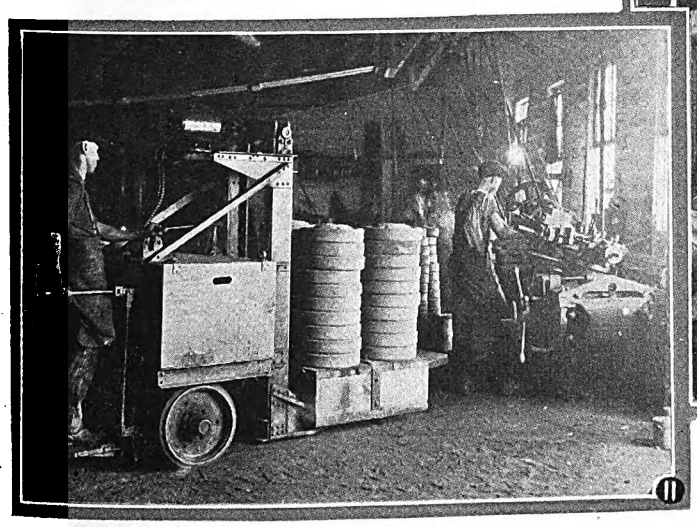


Fig. 11. The special truck can frequently be used on more than one operation. Here is a tiering truck handling skid loads of materials between machine operations at the Medina Mfg. Co.

ing materials to machines (figure 10), work benches, etc. Today they are recognized as combining the advantages of high and low lift trucks and they have so many possible intra-plant applications that a simple arrangement of the movement of materials will keep them constantly busy. They can be used to lift loaded skids from the floor, transfer them to a given place, and raise them to such a height that the cost of stacking or tiering in storeroom, freight car, steamship hold, etc., is reduced to a minimum.

With old hand operations, a large food distributor used to place a skid load of material on the floor, and then have the lift truck bring a second skid load, and in order to conserve space, two men took the goods from the second skid, and piled them on top of the first skid load, thus necessitating the breaking down of the piles

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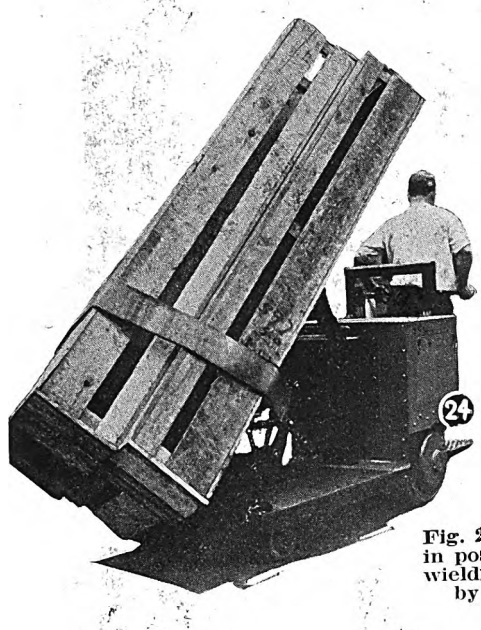


Fig. 24. The flexible band holding the load in position makes it possible to grip all unwieldy packages so they can be transported by mechanical instead of man-power.



Fig. 25. Many trucks have been designed for handling rolls of paper. This view shows how rolls of paper are picked up on this type of truck.

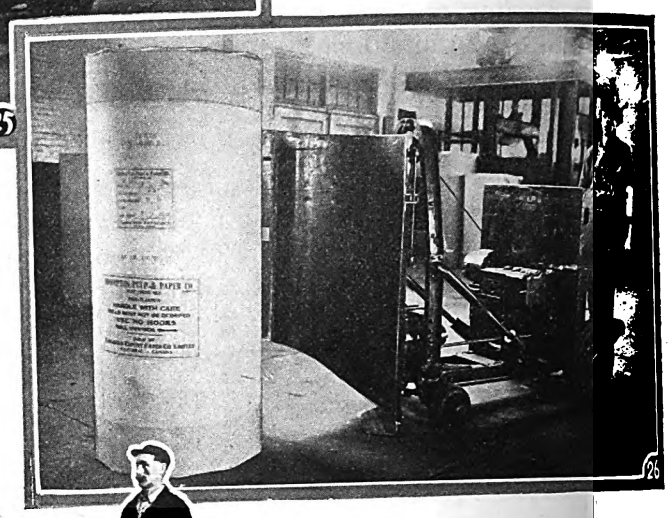


Fig. 26. Same truck shown in fig. 25, but showing the position of the roll when it is unloaded. The load is transported in an inclined position.

shipped per week. As previously stated, formerly from 5 to 9 men were required to truck the wheels and to load the cars. Since the tiering truck is available for this operation, one operator and two men do the work, loading a car in one and one-half hours, at an estimated saving of $20. The method employed in loading the box cars is found to be the most efficient, in using the time of the men and the truck. In piling the fly wheels in the car, they are rolled through the car door back into place. Further, the time saved by setting the skid load of wheels into the car door would not be sufficient to warrant the construction of a runway under the car and across the rails, so that the front wheels of the truck would have a place to rest on while placing the skid load directly in the car. The truck is therefore run parallel to the freight car and places the skid on a movable platform as shown in the illustration, figure 13. The floor of the skid, when placed in position, is level with the car floor.

This particular installation illustrates that a systematized handling plan, even employing special trucks, is applicable to the smaller shops, as well as to the larger concerns, which have more intricate processes and many departments. The saving in money, time and space is perhaps of even great-

(Continued on page 28)

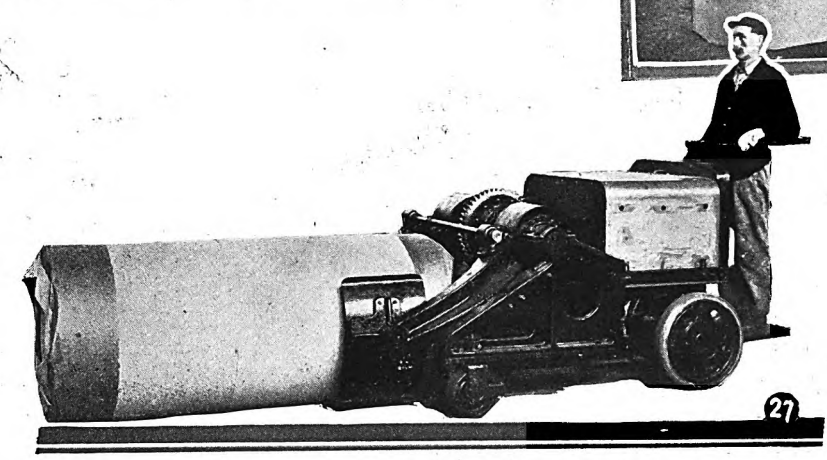


Fig. 27. A different type of paper truck performing the same operation. Note the resemblance to a man's hands in the grips. Fig. 28 shows the roll upended.

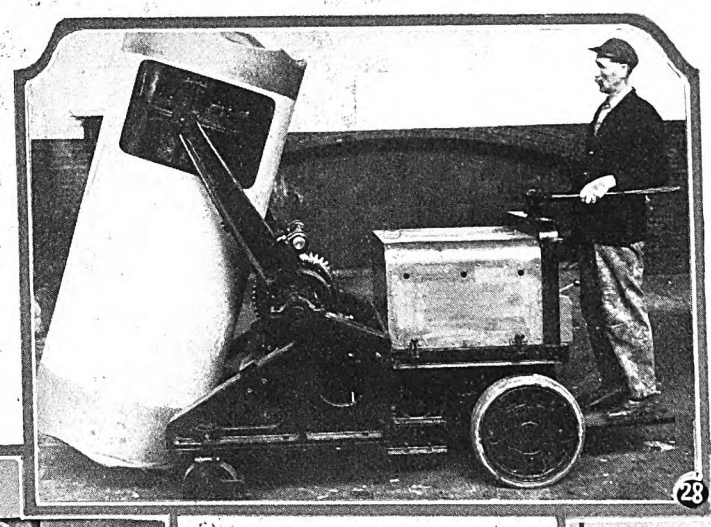


Fig. 28. The use of this truck in one paper plant effected the savings of $21,000 per year in wages alone on the basis of 300 working days.

Fig. 29. The charging of furnaces in a number of industries is a difficult problem. This electric truck does the work at a very low cost.

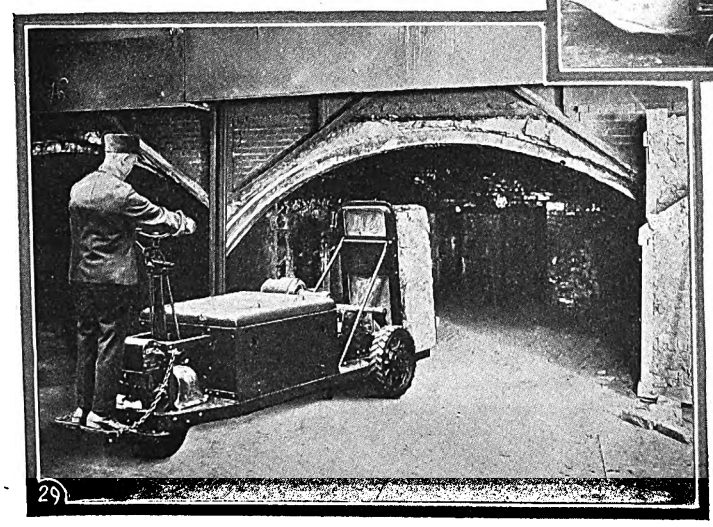




Fig. 30. Charging trucks can also be used for handling materials about the yard and plant, when they are not busy charging the furnaces.

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Training the Inexperienced Worker

By James Wade Russell, M. E.



Fig. 1. The Central Training Section, where the larger part of the newly employed personnel is received for training.

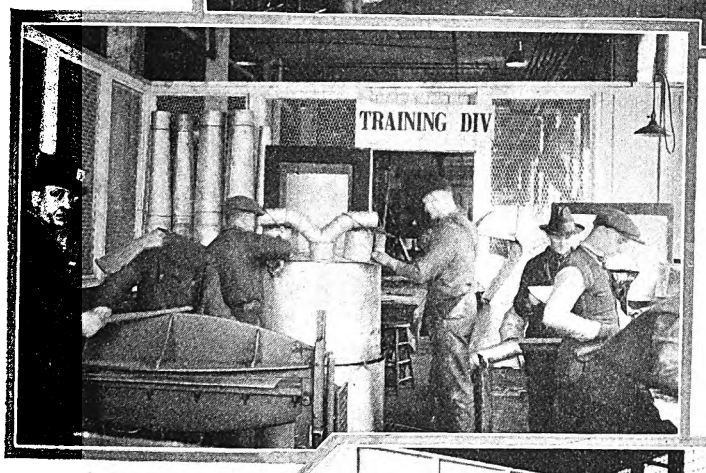


Fig. 2. One of the Segregated Sections for specialized training: a fenced-off section of one of the plant departments.

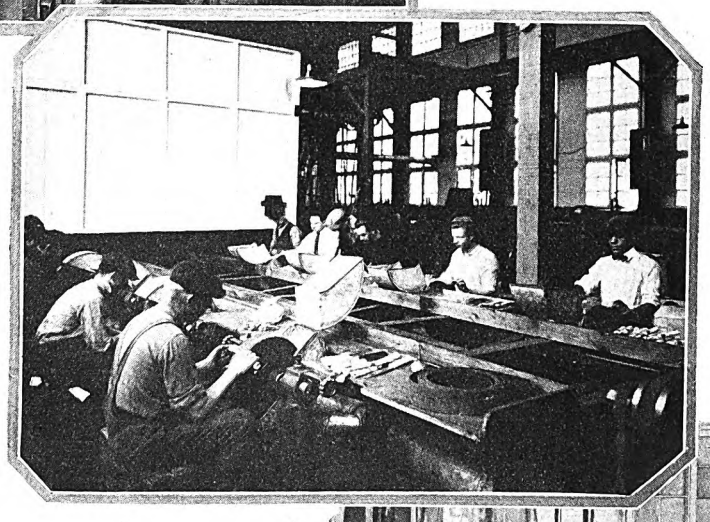


Fig. 3. At the right, men are glazing butcher knives; an example of the training on actual production work.

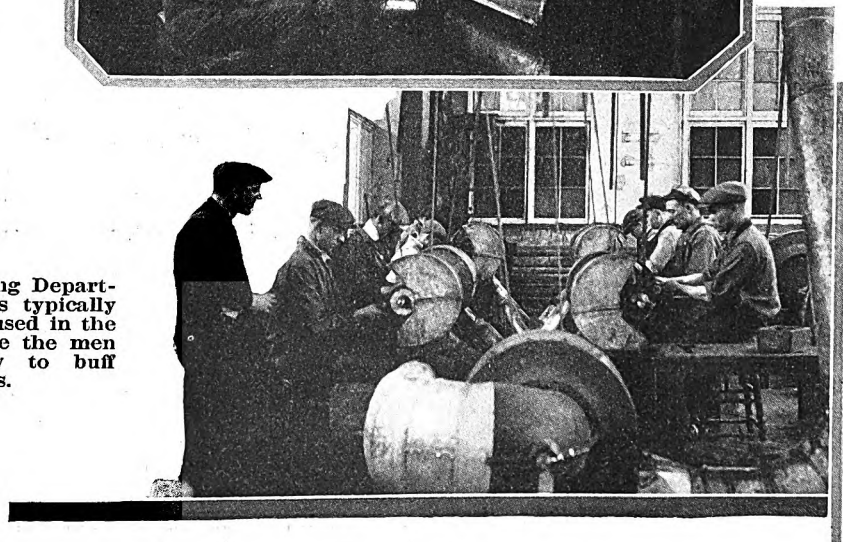


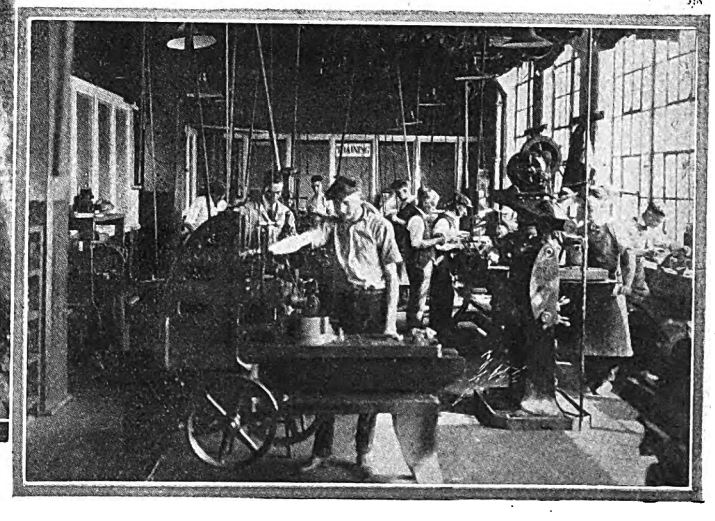
Fig. 4. The Training Department equipment is typically the same as that used in the plant proper. Here the men are learning how to buff flashlights.

THE term Vestibule School was adopted by America from England. A great many people believe that the name was "born of the war" and adopted by American industries at that time, but as a matter of fact the term was used previous to the war both in England and Germany where the need of industrial training was recognized years ago. In fact, the Germans were the pioneers in industrial training activities long before the war, and studies were made by Americans who visited Germany, Switzerland and Belgium and the ideas were brought to America some fifteen years ago.

The development of Vocational Training had been very rapid in America previous to the war, but only in the form of intensive trade training in city, state and corporation trade schools where the prejudice of the old Manual Training Plan had to be broken down before the trade idea was enabled to take root and grow —this took about ten years, but only after it was clearly shown that a boy or girl could master a three year trade in two years, made possible through training by the "intentional" method rather than the old

(*Continued on page 51*)

Fig. 5. Below—Up-grading machinists and tool-makers. Training is not only for novices, but also offers a path for advancement to experienced workers.



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Why the Superheater?

The Principles of Steam Superheating and the Economies It Brings About

BY JAMES T. BEARD, 2ND

THE approach of another winter finds the industrial world again face to face with their power problems and, more particularly, with the fuel problem and its effect upon the ultimate cost of the finished product and the profits of the enterprise. It is but natural that, during a coal crisis, deliveries are more or less unreliable and the quality of the coal when delivered is still more uncertain.

But whether there is a crisis or not the present high cost for fuel of any kind has made the power department of every industrial plant one of the most important factors in its daily operation and has directed the attention of the management to that department, with a view to eliminating unnecessary waste by effecting economies and cutting costs in every possible way.

These efforts toward efficient operation have necessitated intelligent supervision of a very high order, combined with improved methods of operating the plant and handling the equipment. In addition it has often been advisable to make alterations in the design and equipment, either by replacing old equipment with more modern and economical types, or

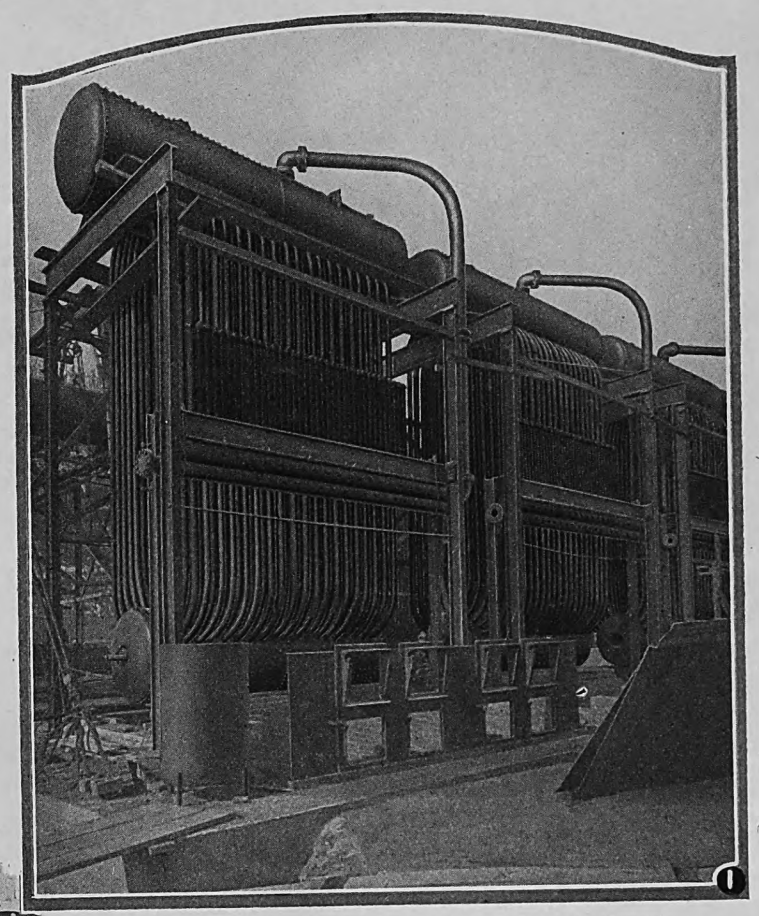


Fig. 1. The illustration shows the usual arrangement of superheaters installed in Erie City vertical boilers. These boilers are located at the plant of the Jones & Laughlin Steel Company, Woodlawn, Pa.

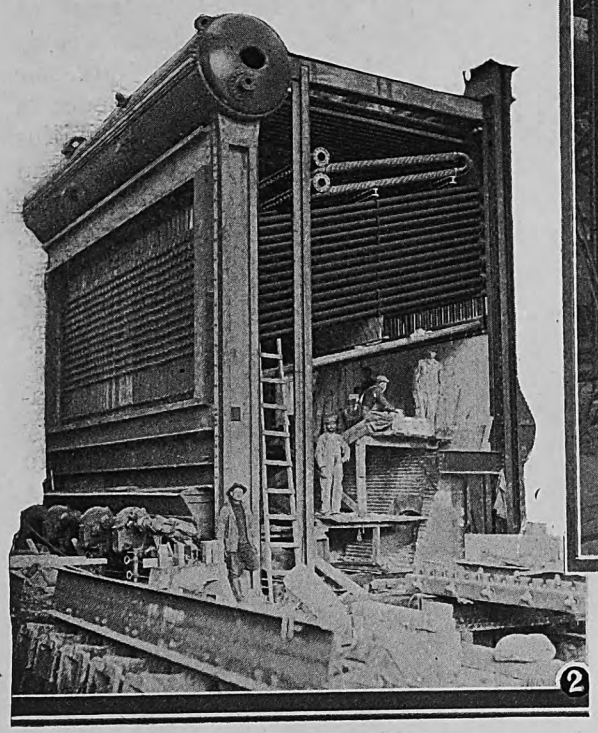


Fig. 2. One of four similar units of 1232 hp. capacity in the plant of the Appalachian Power Company, Glenlyn, Va., showing a superheater unit installed in a B & W cross-drum boiler.



Fig. 3. In this installation a superheater is shown in a Springfield boiler. The superheater is supported by U-bolt strap around the drum and by hanger beams and rods from overhead structural steel members.

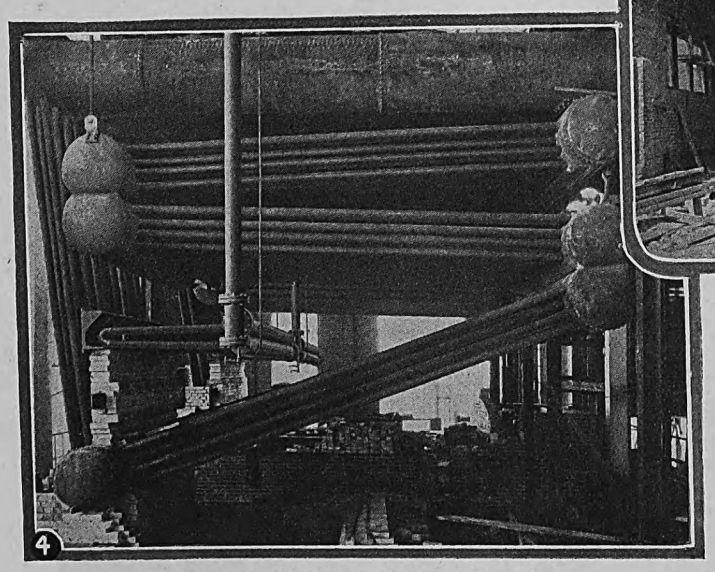


Fig. 4. Twelve of these 500 hp. Vogt boilers in the plant of the Standard Oil Company, Sugar Creek, Mo. are equipped with superheater units. The superheater headers are suspended from the boiler drums by means of air-cooled U-bolts.

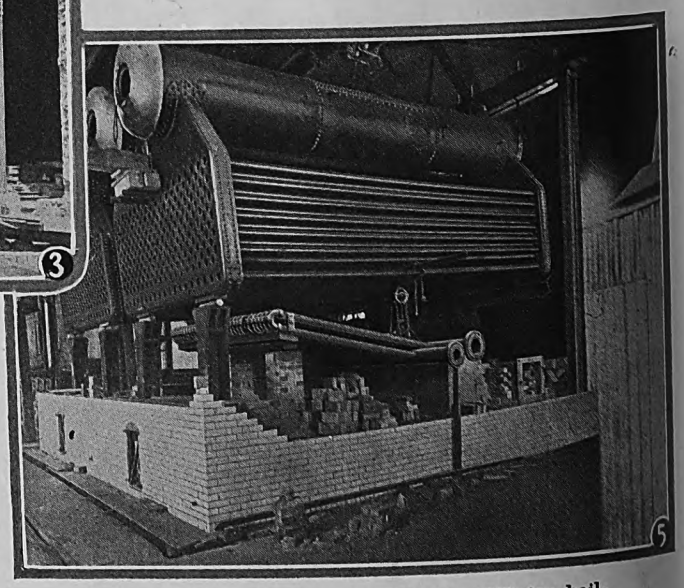


Fig. 5. Superheaters installed in O'Brien boilers in the plant of the St. Louis Water Works. The superheater units are located below the tube bank and behind the bridge wall. Headers are supported on pedestals from the floor. This arrangement is also used on Heine, Erie City, Franklin and other types of horizontally baffled boilers.

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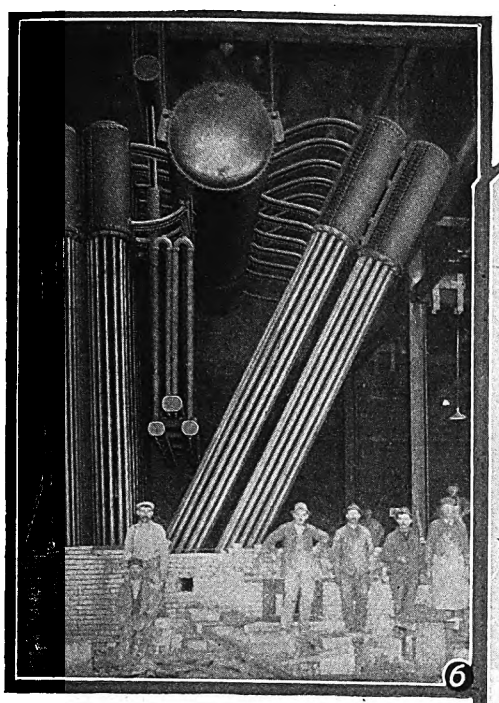


Fig. 6. Four of these 1375 hp. Bigelow Hornsby boilers in the plant of the Niagara, Lockport and Ontario Power Company, are equipped with superheaters, of the double deck type to give a high superheat.

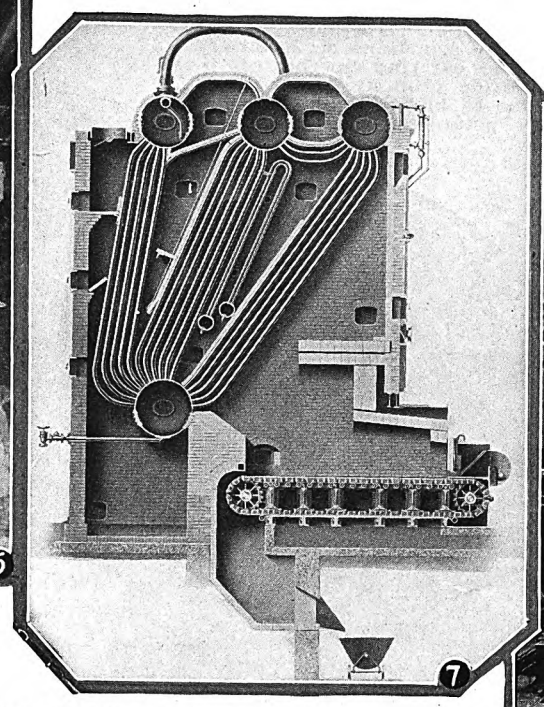


Fig. 7. Sectional View of a Stirling boiler installation equipped with a superheater unit. The hot gases come in contact with the superheater tubes after giving up some of their heat to the first bank of boiler tubes.

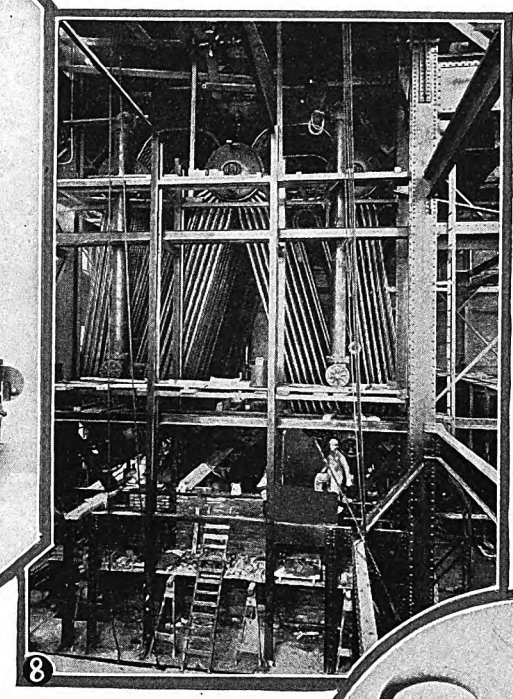


Fig. 8. A large installation of Stirling boilers in Power House No. 2 of the Detroit Edison Company, showing one of the units being equipped with superheaters.

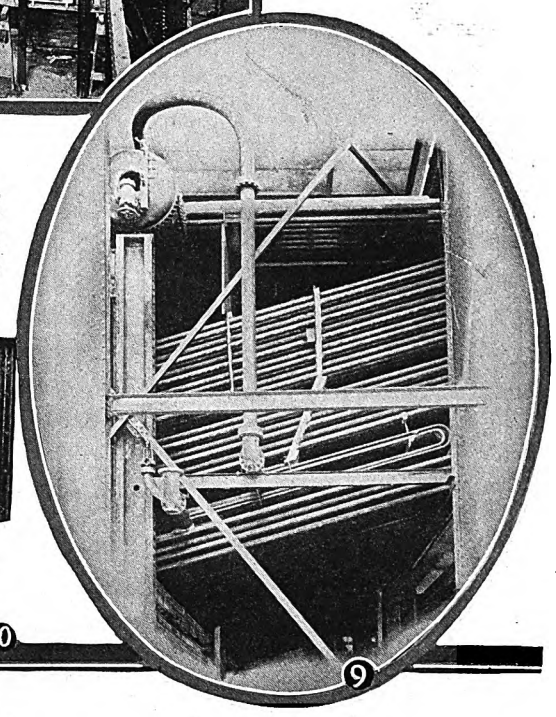


Fig. 9. A close-up view of a superheater showing an arrangement whereby the superheater is placed among the boiler tubes just above the lower rows.

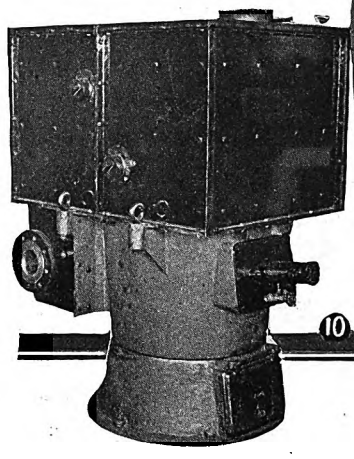


Fig. 10. A portable superheater unit which is separately fired. This unit has a capacity of 1000 pounds of steam per hour.

by the installation of additional devices for preventing heat and power losses that are inevitable with the existing outfit.

In effecting economies in the power plant, and more particularly in the boiler house, the opportunities offered by superheated steam for increasing the overall plant efficiency and thereby cutting fuel and power costs have not been neglected. There is probably no piece of boiler room apparatus, whose possibilities have been less appreciated and which gives less trouble to the operating men than a properly designed and located superheater. At the same time, under the right conditions, it is an effective means for more effectively using the generated steam power and for preventing many of the small losses, which added together often represent a considerable money value.

Considering the boiler as a power house unit by itself, it usually consists of suitable drums, headers and banks of tubes, designed to present a maximum of heating surface to the hot furnace gases for the purpose of rapidly and efficiently evaporating water and generating steam under pressure. The rapid circulation and violent boiling of the water within the boiler shell produces a fine mist or spray, which is often present in the steam as it leaves the boiler. Under such conditions the steam is said to be "wet." When there is no moisture in the steam it is said to be "dry" or "dry saturated."

Steam that is "dry" when

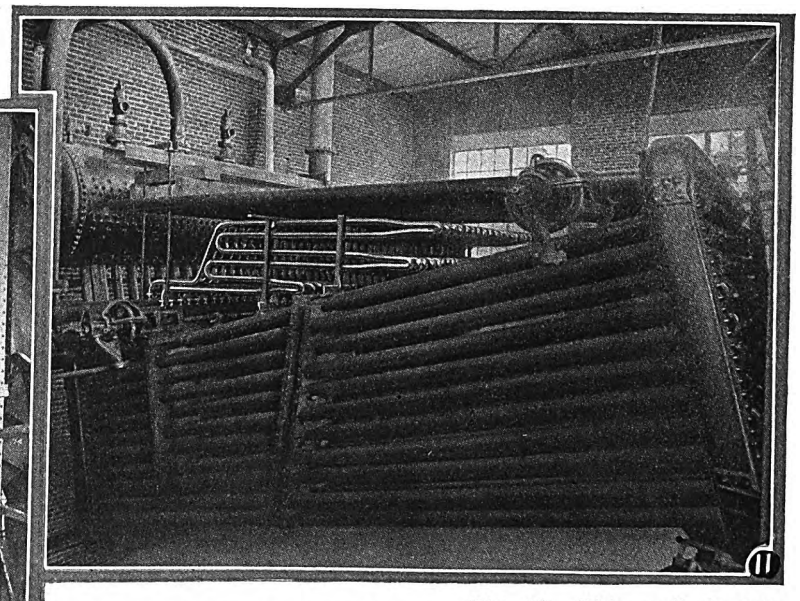


Fig. 11. This unit is one of three 355 hp. Keeler cross drum boilers for the Borough of Chambersburg, Chambersburg, Pa. These units are designed to deliver steam at 190 lb. pressure and 100 deg. superheat when operating at rated capacity.

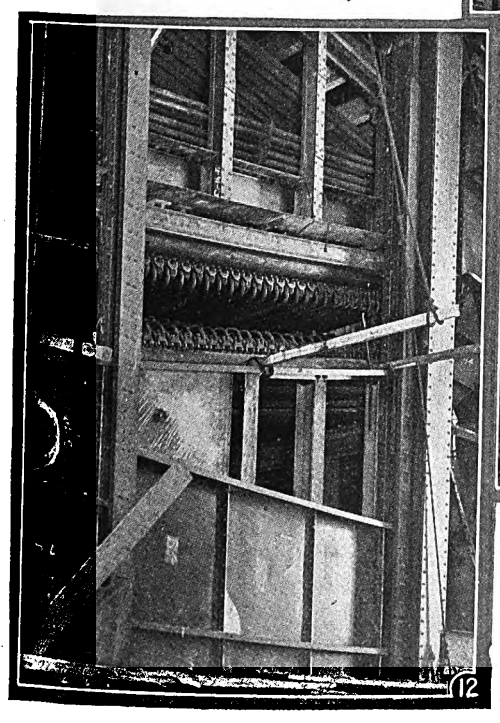


Fig. 12. Close-up view of one type of superheater installed in each of twelve 1890 hp. Springfield boilers at the Hell Gate plant of the United Electric Light and Power Company. With the boilers operated at 200% rating steam is delivered at 225 lbs. pressure and 153 to 225 degrees superheat.

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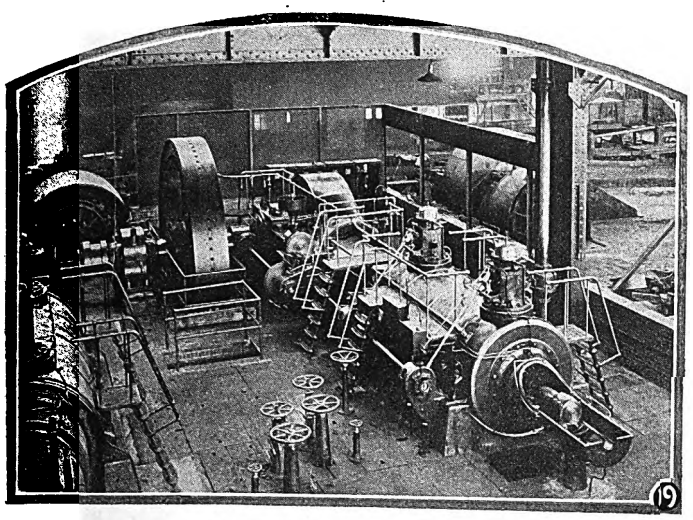


Fig. 19. A very large economical engine of the "unaflow" type designed to operate with 75 degrees superheat and effecting a consequent saving of approximately 12 per cent.

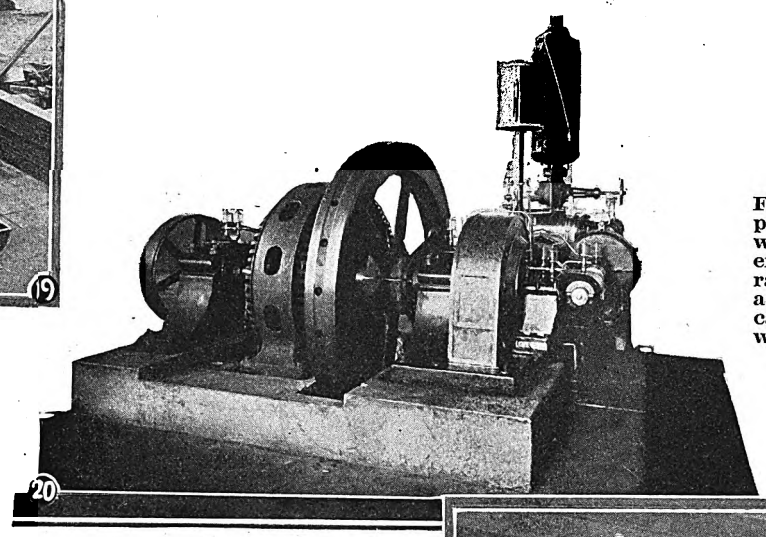


Fig. 20. Small engine units are particularly well adapted to use with superheated steam. Modern engine design has made rapid strides and engines such as shown in this illustration are capable of very high economy when using superheated steam.

comes in contact with the relatively cool walls and internal surfaces of the cylinder and piston. In this connection it must be borne in mind that the internal surfaces of a pipe line may be maintained at a more or less constant temperature, while the cylinder walls are alternately heated by incoming live steam and cooled by outgoing exhaust steam, the expansion of which has caused a marked reduction in temperature. Sometimes this cylinder condensation amounts to 20 per cent of the total weight of the steam.

Since the ability of steam to do work and generate power depends upon its expansive properties, it is obvious that it will be effective and useful only so long as it remains in the

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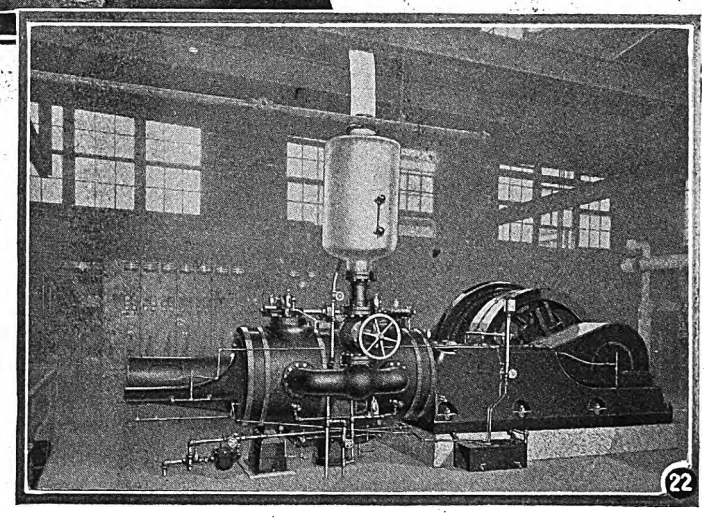


Fig. 22. Showing an unusually economical engine unit of the "unaflow" type. Note the steam separator in the steam line to prevent moisture and other impurities entering the cylinder. With superheated steam the presence of moisture in the steam is practically eliminated.

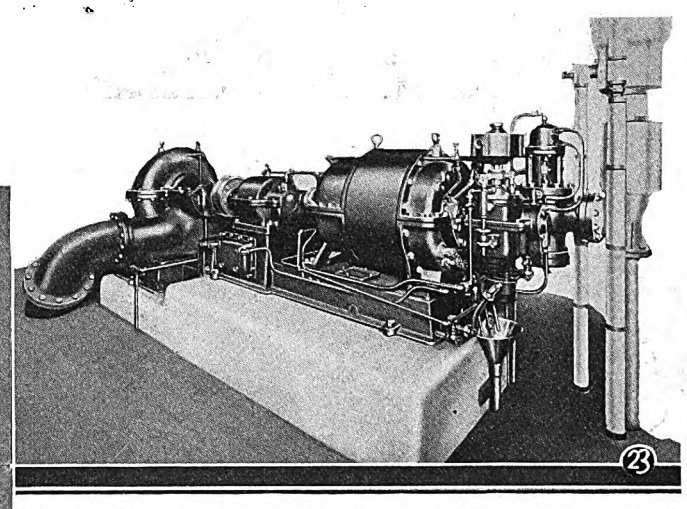


Fig. 23. A 145-horsepower turbine driving a centrifugal pump through reduction gearing—pumping 1,800 gallons per minute against a 165-foot head.

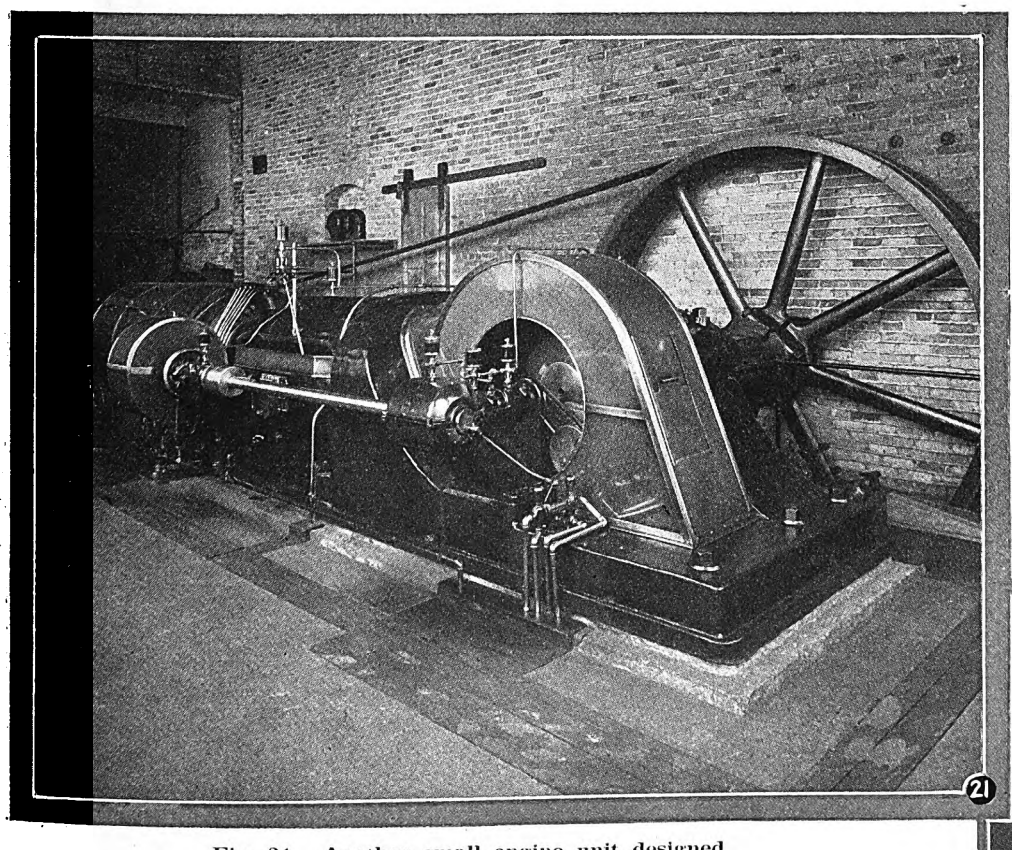
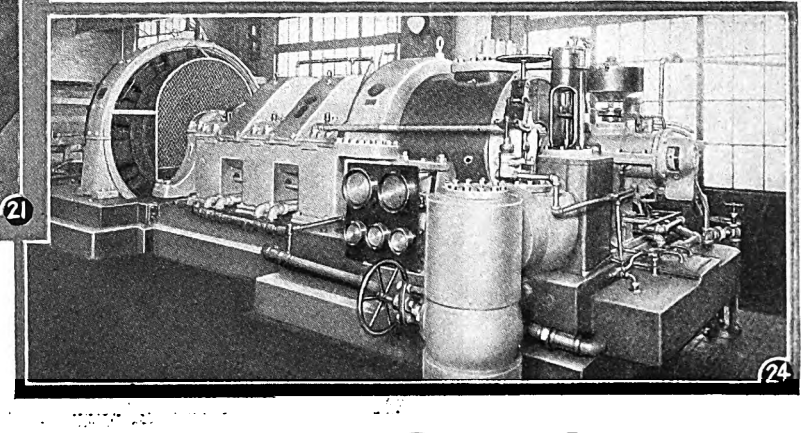


Fig. 21. Another small engine unit designed for operation with superheated steam with the idea of eliminating cylinder condensation and increasing the efficiency thereby.



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Where Minutes Are Vital

How Modern Production Methods Are Applied to a Newspaper

By W. Thomson Lees



Fig. 1. In the third railed enclosure, above, the Managing Editor has his desk. In the far corner are the quarters of the editorial writers.

IT is an unchallenged boast of the *New York Tribune* that copies of that paper were on the street, announcing the death of President Harding, some fifteen to twenty minutes before any other metropolitan daily was able to disseminate the sad tidings. In the publication of a daily newspaper it is minutes—not hours or days—that count. News, like time or tide, waits for no man; and the one overshadowing task of the newspaper man is to get the news into print quickly, just as soon as possible after its occurrence.

The feat of the *Tribune* was not mere luck; it was, on the contrary, tangible proof of the success of years of research and careful planning which culminated in the marvellous new plant on 40th Street, New York.

Throughout this plant there is evidence of two things: that a newspaper, in spite of all tradition to the contrary, *can* be made amenable to the principles of modern, efficient production; and that this efficiency can be made to go hand in hand with comfort and cleanliness



Fig. 2. Well lighted, well ventilated, cheerful offices are no small factor in getting things done.

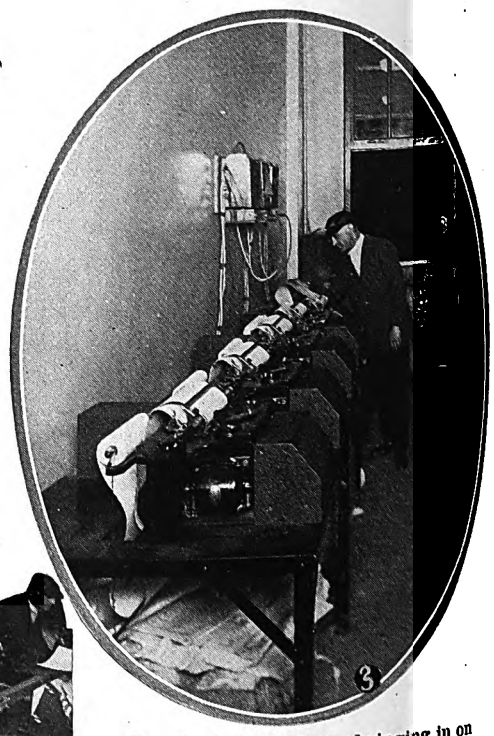


Fig. 3. News tickers, bringing in on automatic printers the grist of the outside news-gathering agencies are installed in a separate room because of their noise.

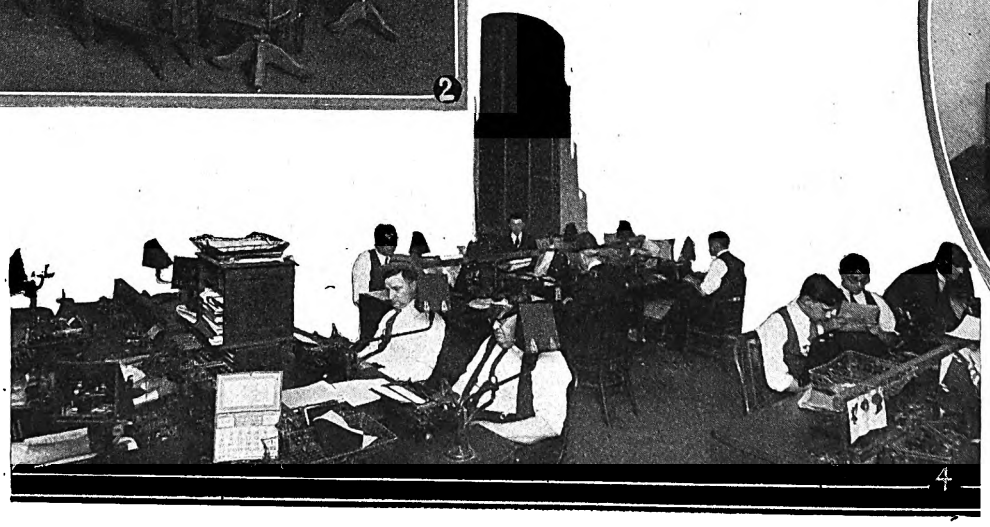


Fig. 4. The telegraph room, with its twenty-five direct wires to all points of the compass, keeps the editorial finger on the pulse of the world.

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Fig. 5. From here—the City room—on the fifth floor, the news begins its journey by gravity from the U-shaped copy desk.



Fig. 6. Here is a part of the composing room, where copy is set up in type and then made up into pages; the type matter being locked in steel forms preparatory to stereotyping.



Fig. 7. A few of the battery of fifty linotype machines with electrically heated melting pots. It is here that the special ceiling, described in the text, deadens sound.



Fig. 8. In the make-up section of the fifth floor, showing more clearly the steel tables on which pages of type-matter are made up. These "forms" of type are wheeled (see Fig. 9) to the steam room.

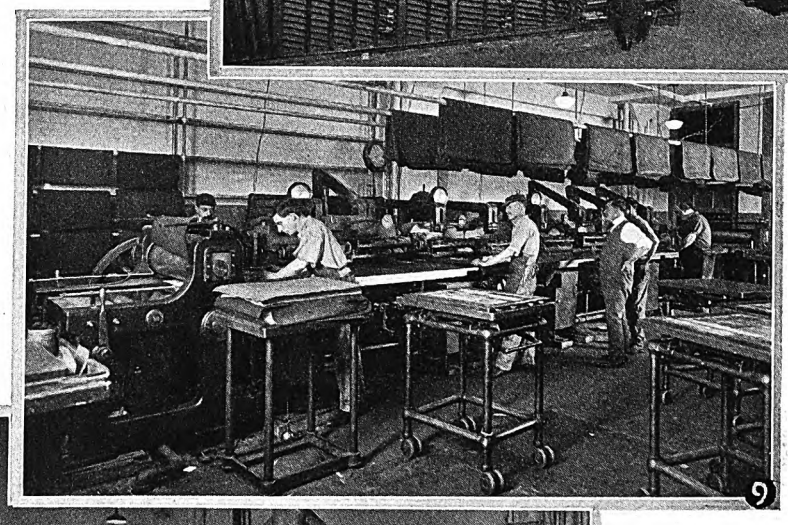


Fig. 9. In the steam room, a papier-mache impression is taken of the type form, under pressure. These papier-mache molds, or "mats," are dropped down a chute to the floor below.



Fig. 10. In the background is the chute from the steam room. The mats are placed in sterotype casters, which produce the curved plates from which the actual printing is done. This room, with its heat and fumes, is separated from the press-room only by a canopy wall; yet the press-room is free from any of the stereotype-room atmosphere (see text).

and pleasant working conditions.

Basically, this most up-to-date plant is planned upon what industrial executives have come to know so well—the straight line-gravity system. Production moves, on each floor, in as nearly as possible a straight line; and, through the entire building, downward to street-level. The advantages of this system are obvious; the application of the system to such a complicated process as the production of a metropolitan daily, however, is not such a simple matter.

For example, the gravity-production-flow plan requires that the presses be located on the third floor. Yet, the huge presses required are of such weight that, at the present writing, only four plants of all the newspaper publishers in the East—have successfully installed their presses on the third floor.

Again, from a time-saving standpoint, the stereotype room should be near the presses; and with unobstructed passage from the former to the latter, so that plates can be put on the press without delay. But the heat and gases incident to the stereotype process are not only detrimental to the press, but furnish an atmos-

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670,000 Horsepower of Electric Heat

What Electricity Has Done for Industrial Heating

BY B. S. BEACH

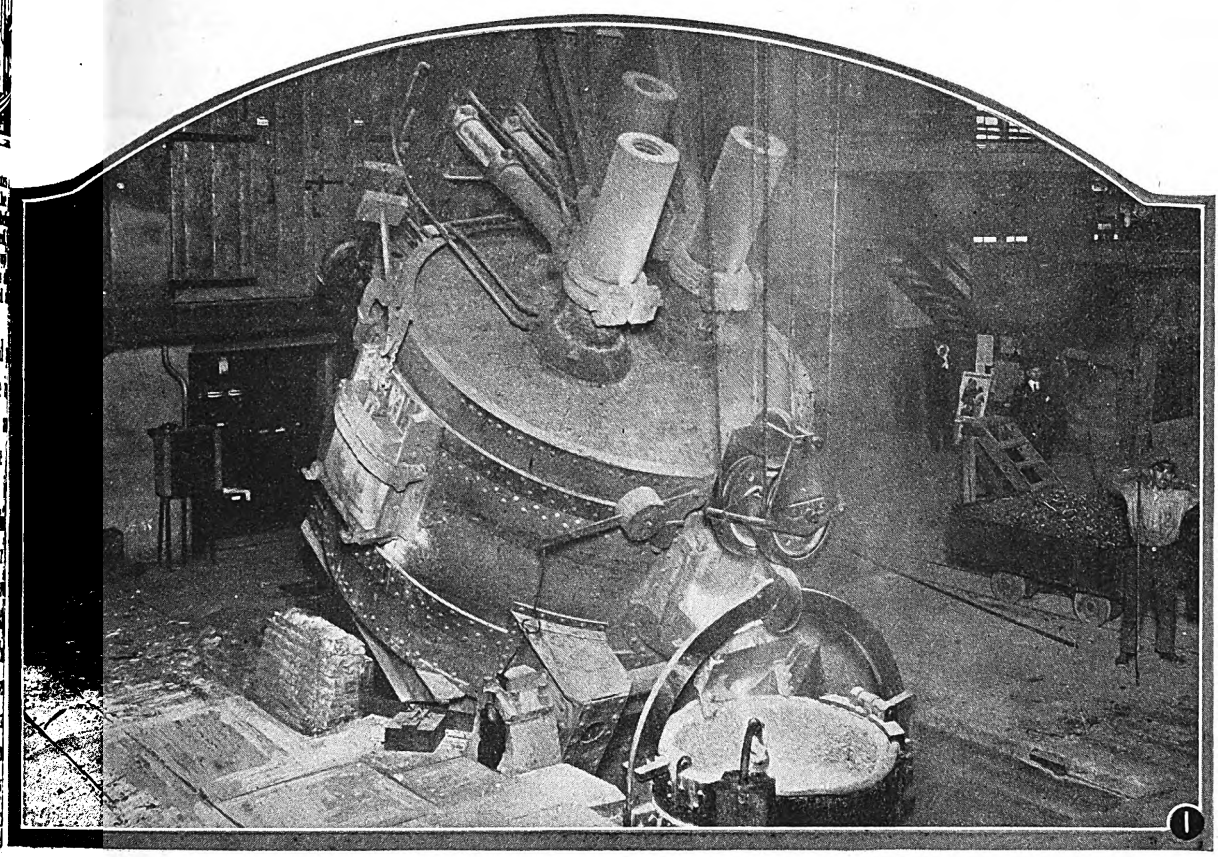


Fig. 1. A six-ton Herault electric furnace in use at the Lynn Works, General Electric Company.

IT is only within the past decade that engineers have come to the realization that heat, generated by electricity has enormous possibilities of industrial development. Of course it has always been known that electricty passing through a wire created heat of varying degrees and intensity, but formerly this was considered more in the light of an unavoidable nuisance than otherwise.

As the electrical industry developed, however, and central stations of ever-increasing size were built, engineers began to look for means whereby these stations could sell their electricity to the best advantage to themselves and the customers they served. This resulted in the rapid development of electric heating devices until today more than 500,000 kw. or 670,000 hp. is used for industrial purposes alone in the United States. This figure represents over 7½% of the electric energy used for all other industrial uses for it has recently been estimated that about 9,000,000 hp. is used by electric motors in manufacturing in the United States.

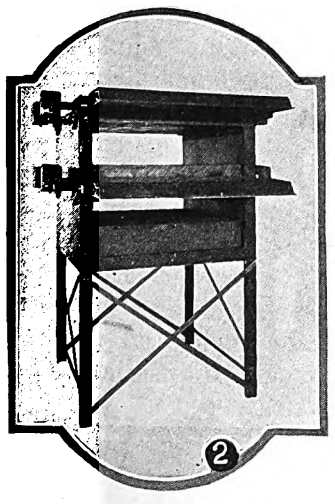


Fig. 2. Special applications of electric heat are what have widened its use. Here is a mica mold heating oven.

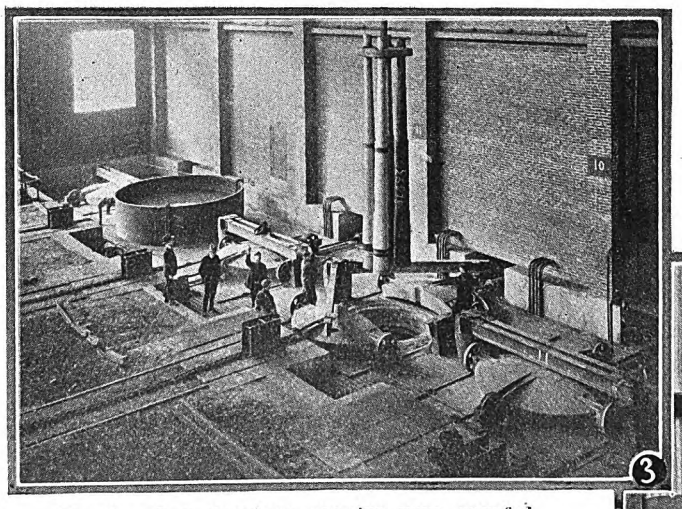


Fig. 3. Gun forgings require very careful heat treatment, and the delicate control of electric heat is a big advantage. These furnaces are installed at the Tioga Steel and Iron Co., Philadelphia.

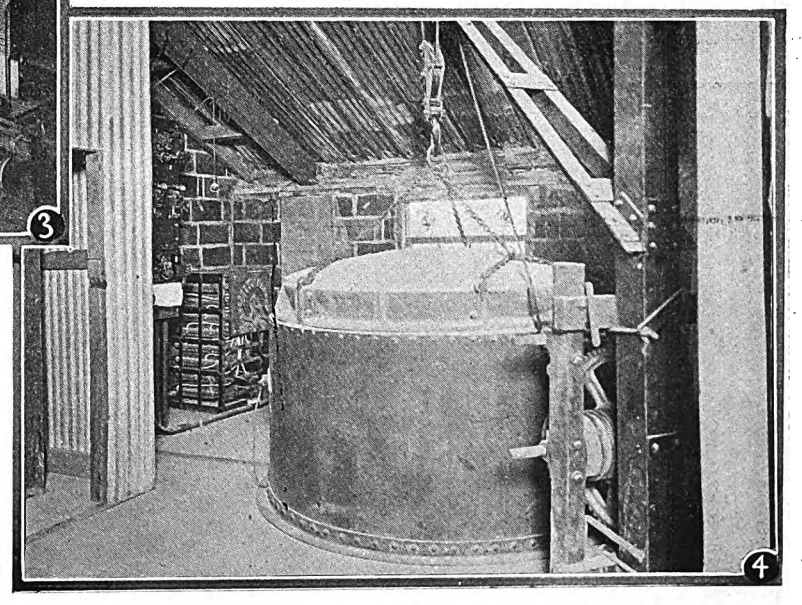


Fig. 4. An electric glass annealing furnace, equipped with automatic temperature control.

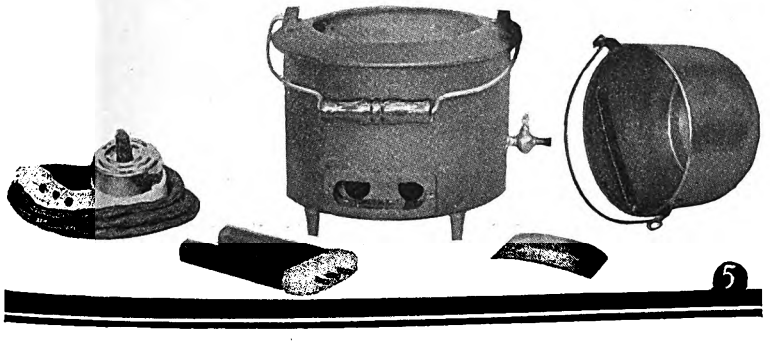


Fig. 5. The "little brother" of the big fellows on this page:—an electrically heated water-packeted glue pot.

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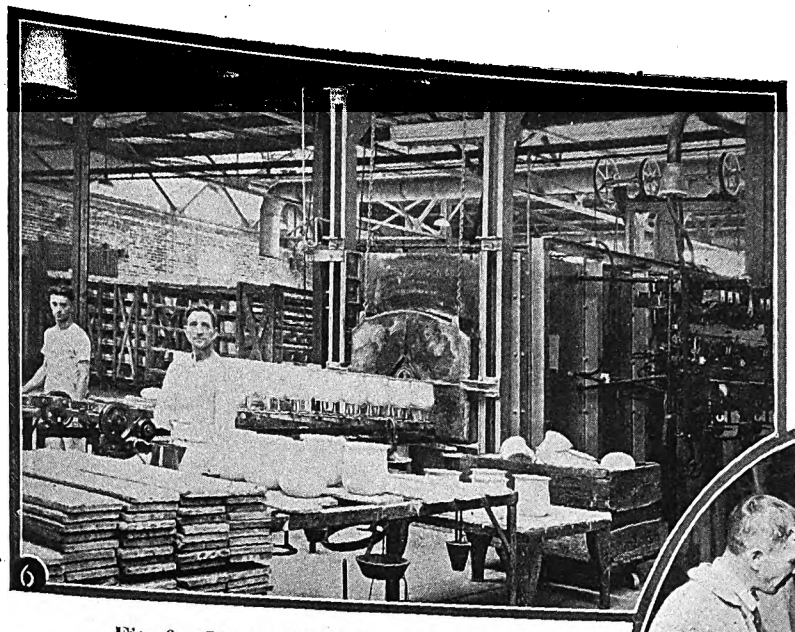


Fig. 6. Here, and at the right, are views of an electrically heated furnace for vitreous enameling.

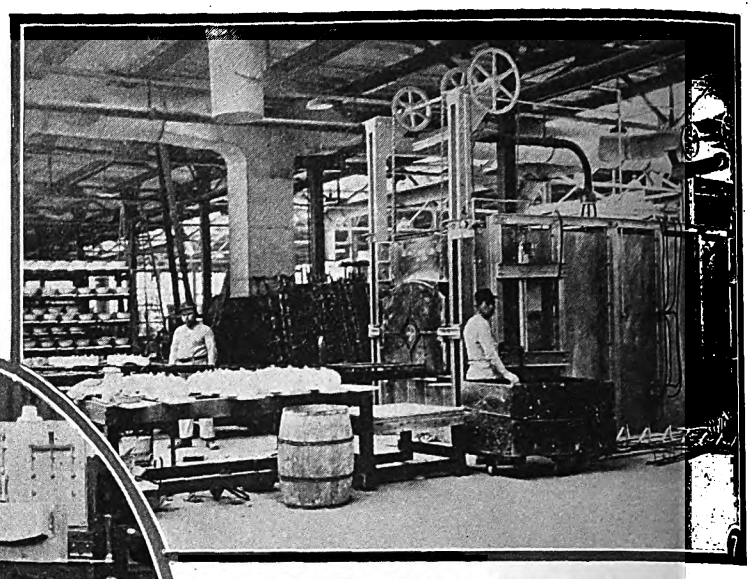
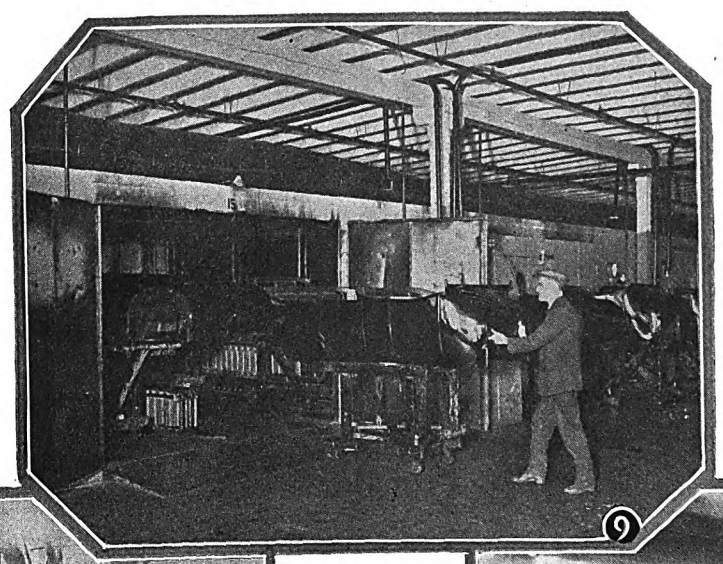


Fig. 7. Another view of the double chamber vitreous enameling furnace of Fig. 6. This is installed at the Coonley Mfg. Co., Cicero, Ill.



Fig. 8. Muffle-type heat treating furnace, for small work.

Fig. 9. Japan baking ovens at the Chevrolet Motor Company plant, Tarrytown, N. Y.



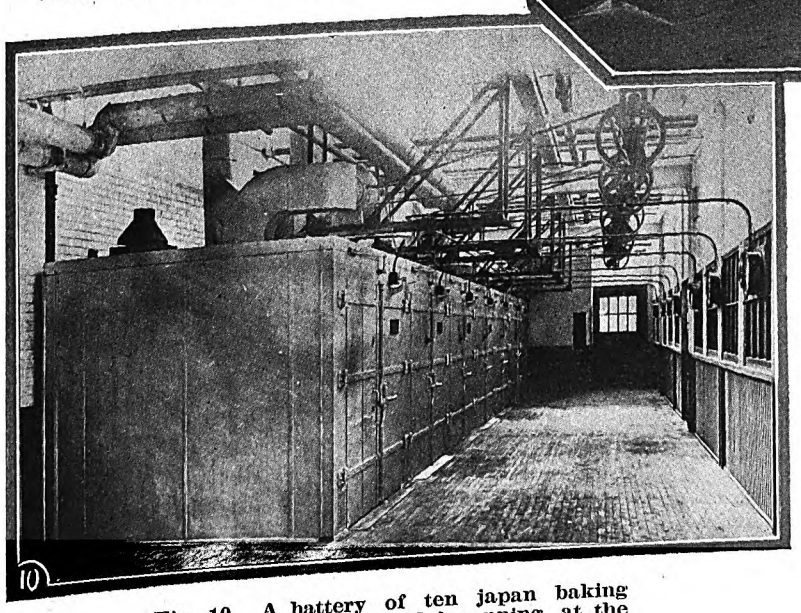


Fig. 10. A battery of ten japan baking ovens in use for general japanning, at the Ritter Dental Mfg. Co., Rochester, N. Y.

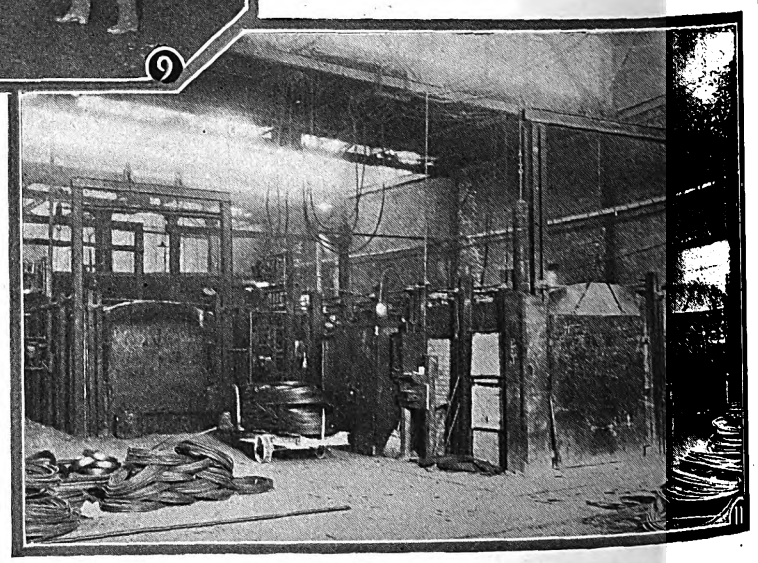


Fig. 11. Wire baking ovens, equipped with automatic control, at the Halcomb Steel Company, Syracuse, N. Y.

The principal factor contributing to the increased use of electric heating appliances is the way in which they answer the modern demand for conservation — conservation not only in the saving of natural resources, but the saving of time, materials and the reduction of the uncertain "personal element" to a minimum as well as the improvement of the product. Despite the fact that the conversion of fuel into electric heat is only reached after a long and complicated series of steps, whose ultimate efficiency is but 20%, it has met requirements so well that, in time, it will undoubtedly replace the use of fuel heating to an enormous extent. At Niagara Falls for example, fully 90% of the energy now generated is used for industrial heating purposes. In fact, its development in recent years has gained such headway that it bids fair to surpass, in energy consumption, both the light and power branches of electrical service together.

With the enormous amount of undeveloped hydraulic power in the country, it is not easy to predict where the final stopping point will be, because it is by water power that electrical energy can be most efficiently developed as regards money input versus output. The limits to the use of electricity, produced hydraulically, can be grasped only when it is realized that there is one hundred and twelve million potential horsepower on the continent of North America still undeveloped.

Most industrial heating of former days was obtained through three mediums—coal, oil or gas. Taking coal as an example in reaching the exceedingly high temperature necessary in some processes, 88% of the B. t. u., or heat units in a pound of coal are used up in merely raising the fuel and the excess air of the furnace to the required temperature, thus wasting the natural resources upon which we depend so much, and making the average industrial town

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anything but a healthy or pleasant place in which to live.

With electrical heat, temperatures that are impossible to fuel-generated heat are reached quickly, economically, and without any consequent defilement of the surrounding atmosphere. Along the same line of conservation, manufacturers are beginning to realize that the elimination of spoiled, and unfit products, whether rendered so by inefficient and unreliable methods of heating, or by careless employees, is just as much conservation as anything else. Also the elimination of unnecessary labor, and the establishment of cleaner, safer working conditions tend toward the attainment of the rapid rate of production which is the paramount demand of the present industrial era.

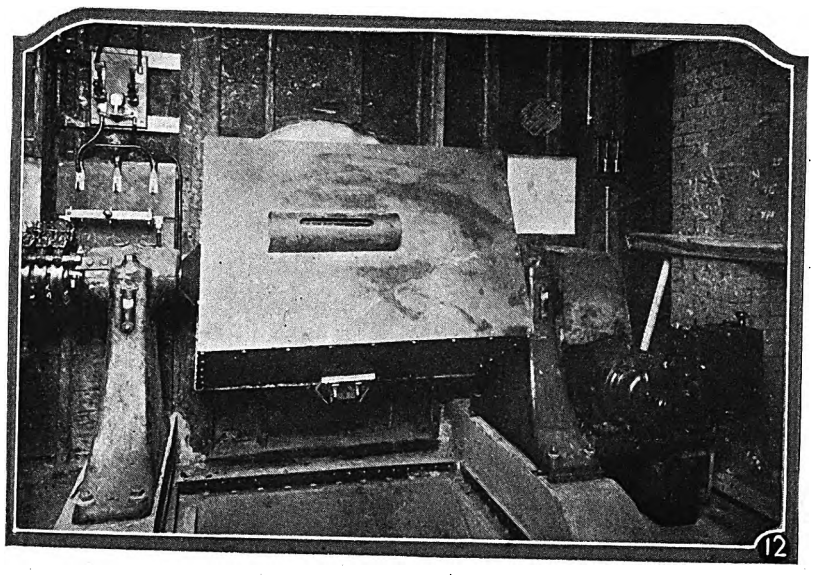


Fig. 12. The sherardizing process, with its importance as a rust preventive, has led to the design of such machines as this 40-inch electric sherardizing machine.

Thus the variety of processes to which electric heat is applicable has given rise to many devices for its use, ranging all the way from a metal melting furnace, whose production is 18,000 lbs. per day, through the oven field, to small metal melting pots with a capacity of 25 pounds of metal. In the domestic field 25,000 electric ranges and an uncounted number of small household appliances are in use. All furnaces, ovens, etc., are remarkable for their reliability, economy and the perfection of their finished products.

To take the brass furnace as a typical example of what can be done by the application of electric heat in overcoming the difficulties of specialized operation, in the fuel-heated brass furnace, one of the greatest drawbacks is the loss of zinc through volatilization and oxidation due to the high temperature of the applied heat, as well as the atmospheric conditions surrounding the bath.

In the electrically heated brass furnace both these conditions are absolutely under the control of the operator. There are several types of brass furnaces in use today—namely—the arc type, which has no automatic control but a low first cost; the induction, which just fits a field where productions can be placed on a 24-hour basis; the carbon resistor, best for temperatures not exceeding 1,000 C; and the muffled arc type, more expensive, but the only one that can be operated automatically.

(*Continued on page 46*)

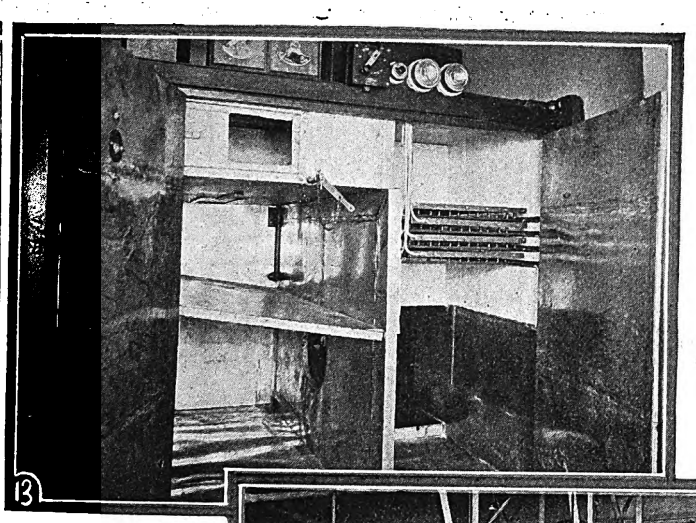


Fig. 13. The Detroit News Company, Detroit, Mich., uses this electric oven in the production of electrotypes.

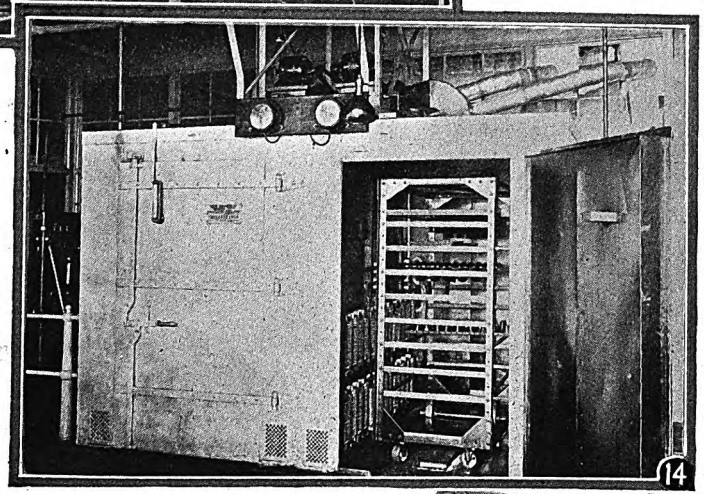


Fig. 14. These enameling ovens are a part of the production equipment at the plant of the Rausch & Lomb Optical Co., Rochester, N. Y.

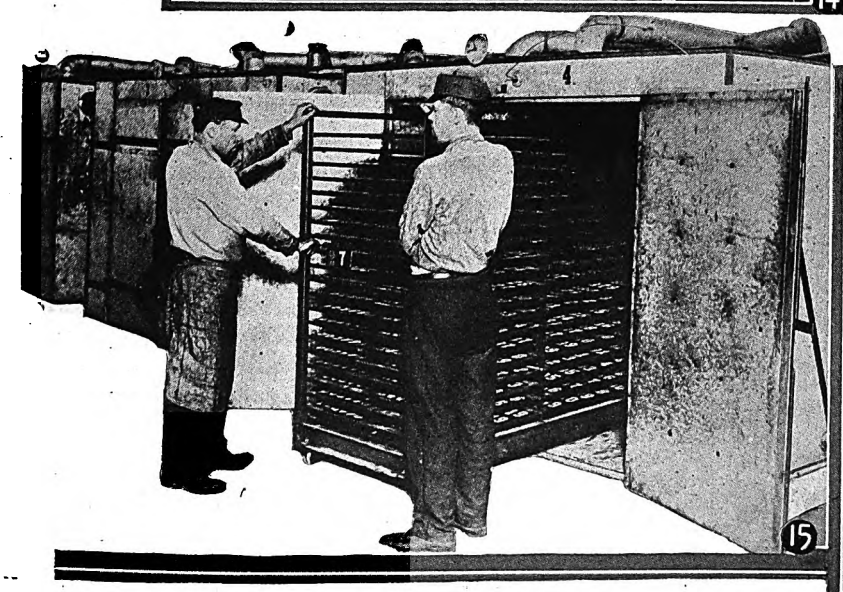


Fig. 15. Electric ovens have even been sentenced to jail! Baking japan on automobile license tags, Ohio State Penitentiary.

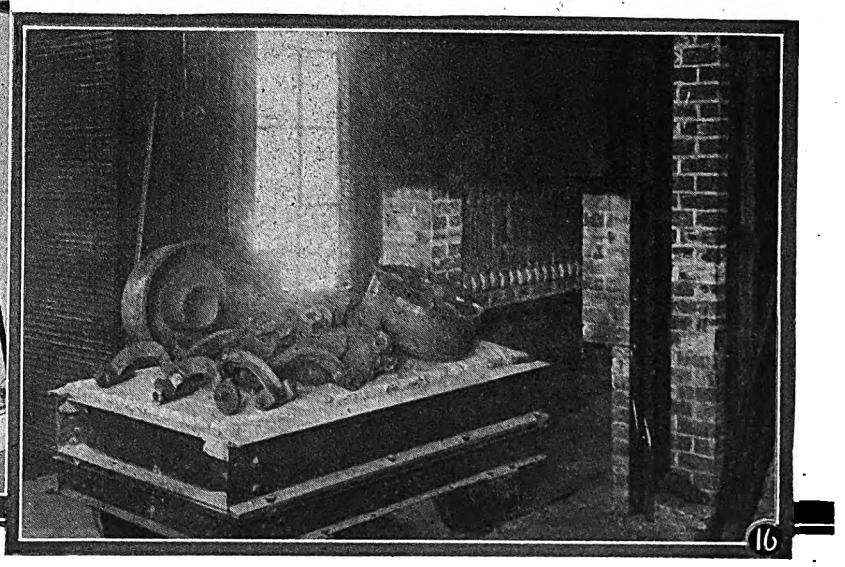


Fig. 16. Here is a car-loaded heat-treating furnace for heavy parts, at the Connecticut Electric Steel Co., Hartford, Conn.

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The Petroleum In

By Roy

Manager of Industrial Relations

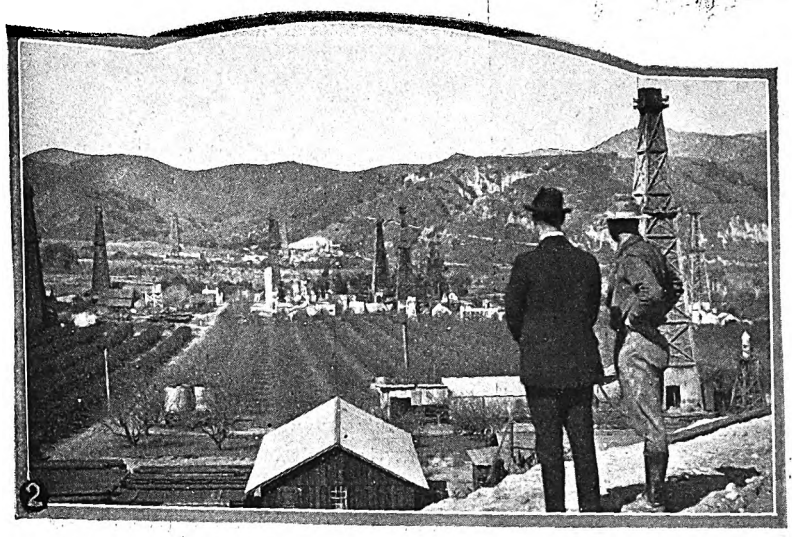


Fig. 2. Part of the Ventura Field on the Pacific Coast, near Ventura, Calif. This is one of the promising newer fields and has the only large producing wells near the coast line north of Los Angeles and Orange Counties.

BECAUSE of its strategic position in world oil operations, the California petroleum industry is especially worthy of study. From its romantic beginning to the present place of leadership among the states producing oil, the story is full of dramatic episodes. In what follows, we have tried to sketch only the essential features which are determining the present trend in California oil circles.

The most spectacular change occurring in the petroleum situation during recent months has been an unparalleled increase in the production of light refinable crudes in Southern California. On January 1st, 1921, there were forty-three producing companies south of Tehachapi Pass. In January, 1923, there were one hundred and seventy-five individual and corporate producers in Los Angeles and Orange Counties, where three great new oil fields had been discovered at Santa Fe Springs, Huntington Beach and Long Beach, and several other smaller fields, all highly productive, were being rapidly drilled. The flush production taken from the three most intensively drilled territories exceeded 41,000,000 barrels. In the space of only a few months $58,000,000 were spent in drilling and other field operations.

In sixteen months, from January 1, 1921, to May 1, 1923, this limited area produced 90,700,000 barrels, thus nearly equalling the annual production of California in 1917. Largely because of these new fields, the annual production of the State jumped from 114,

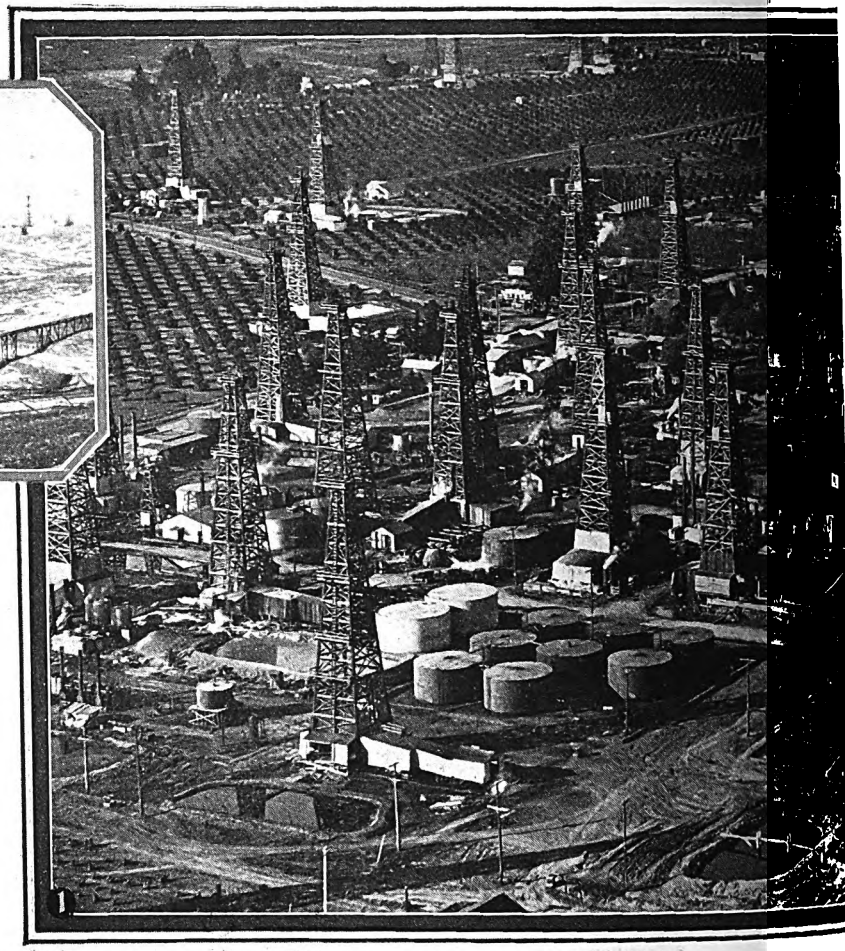


Fig. 1. An airplane view of a section of the Santa Fe Springs field, near Los Angeles. These wells average an initial production exceeding 4,000 bbls. per day of high gravity oil.

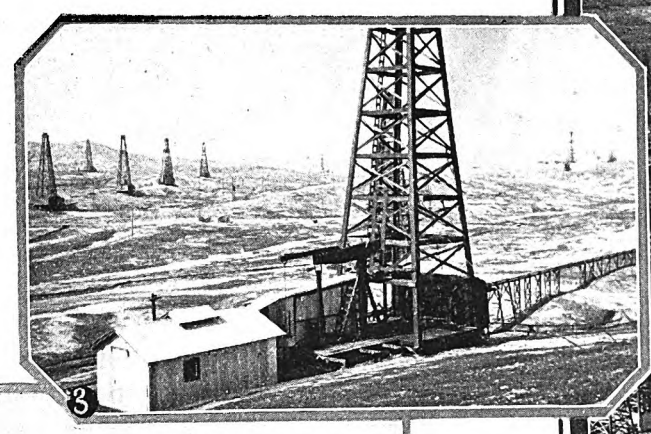
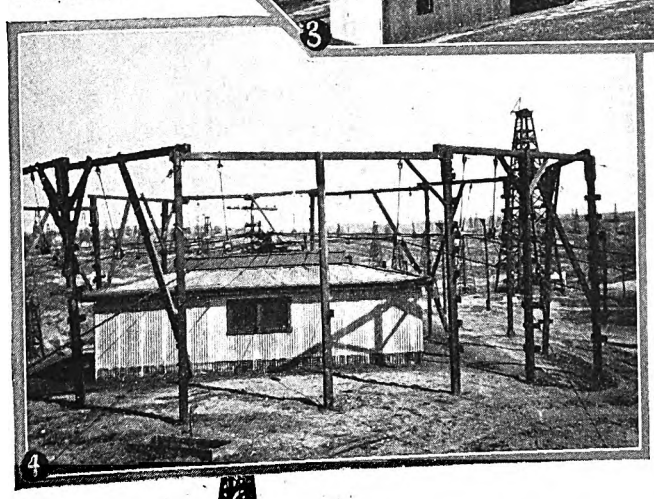


Fig. 3. A modern pumping equipment in the Kern River fields. The pump is operated by an individual motor. The oil is carried away by an open flume system which allows the sand and water to be separated before it reaches the shipping tanks.

Fig. 4. A jack plant used for operating a large number of small producers in one of the older fields. This is the most economical method of pumping oil.



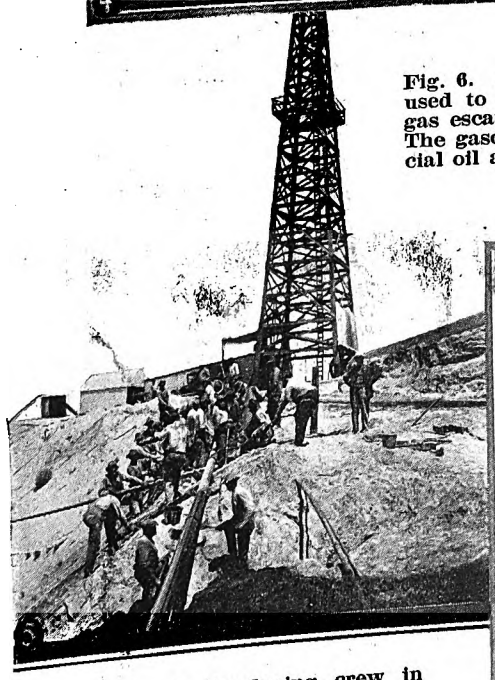
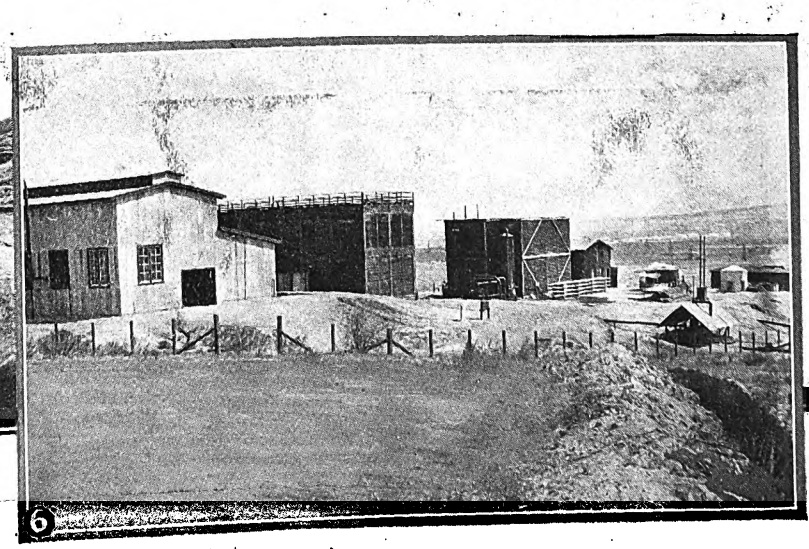


Fig. 5. A pipe-laying crew in the Elk Hills, not far from Taft.

Fig. 6. A typical absorption plant used to extract gasoline from the gas escaping from the well casing. The gasoline is absorbed by a special oil and later driven off by distillation.



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dustry in California

WILLMARTH KELLY
Associated Oil Company of California

850,000 bbls. in 1921 to 139,626,000 bbls. in 1922, this in spite of the fact that hundreds of wells in the older fields were not producing.

Because of their position in a rapidly expanding industry, managements of the various oil companies have been compelled to play the part of pioneers in many directions. Control of widely scattered organizations employing thousands of persons; development of machinery and processes suitable to rapidly changing demands; the attraction of capital in large amounts to enterprises of questionable security—all present grave difficulties.

The industry as a whole may be roughly divided into five major divisions, namely: producing fields, marine and pipe line transportation, refining, and marketing. To these must be added the general offices which serve the multifarious operations of each oil corporation.

In the past, fluctuation from the condition of over-supply to one of scarcity of crude oil, have caused serious losses to companies engaged in only one phase of the business. Thus, during one industrial cycle, the producer of crude is paying good returns on his investment while the refiner is losing money, and in the next cycle, the relative positions are quite the reverse. This situation led foresighted oil corporation managers to adopt a type of organization which enables a single corporation to drill and operate the wells, transport the crude, run refineries and distribute the finished products to the consumer.

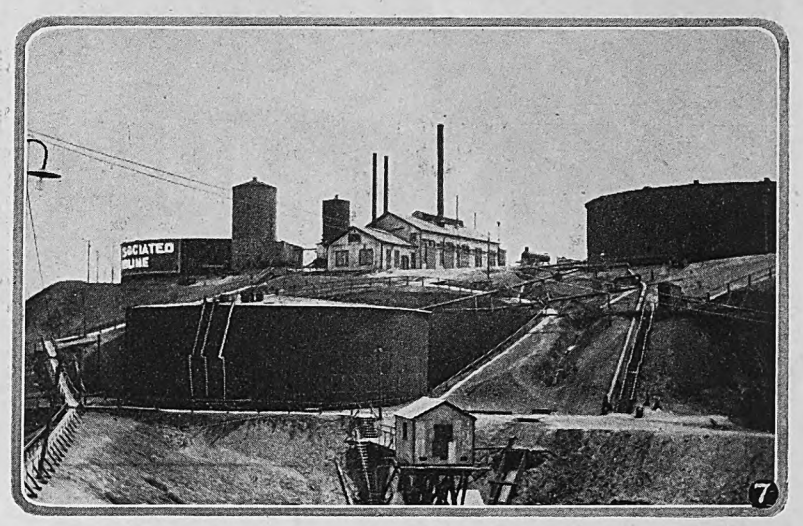


Fig. 7. Pipe line pumping station and shipping tanks near Port Costa. This station is supplied by two 8″ pipe lines, with a total capacity of approximately 60,000 barrels per day. Vessels are loaded by gravitation from storage tanks 350 feet above the Bay, which pressure enables boats and cars to be loaded faster than at any other loading station in the world.



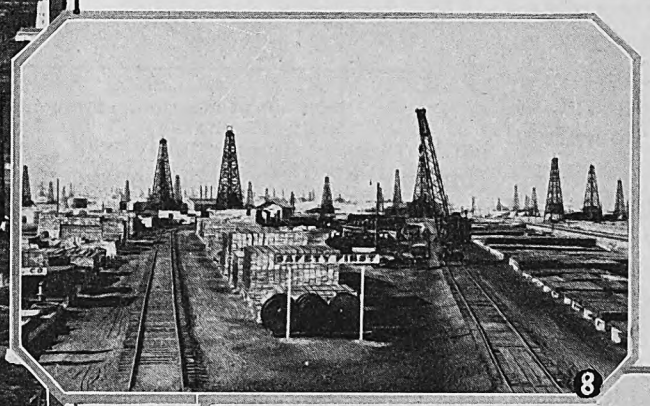


Fig. 8. Store yards and warehouses for oil field supplies, maintained by a large company.

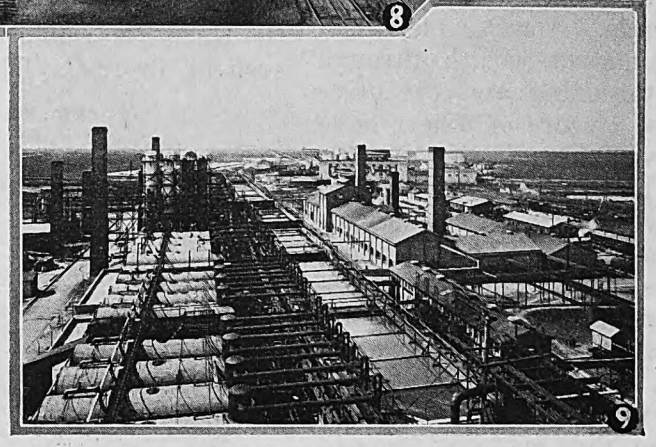


Fig. 9. A typical California oil refinery, located on Suisun Bay, northern arm of San Francisco Bay.

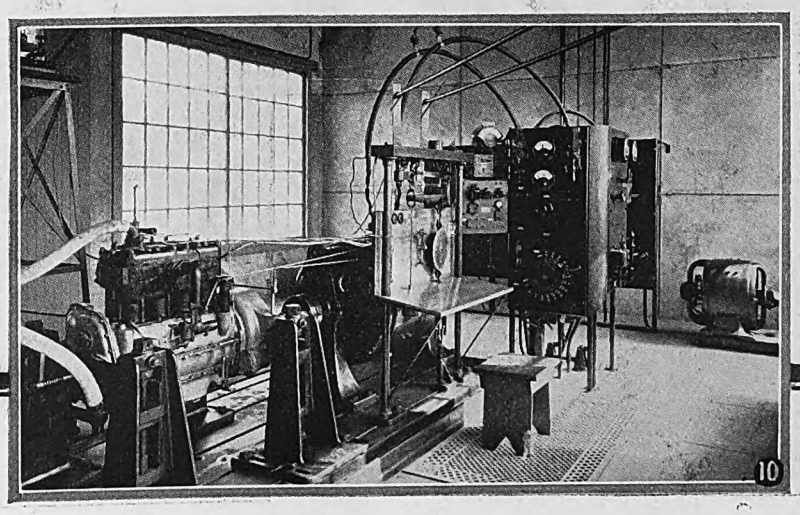


Fig. 10. Motor testing laboratory at Avon. Very exacting tests are made of both lubricants and petroleum fuels under actual operating conditions.

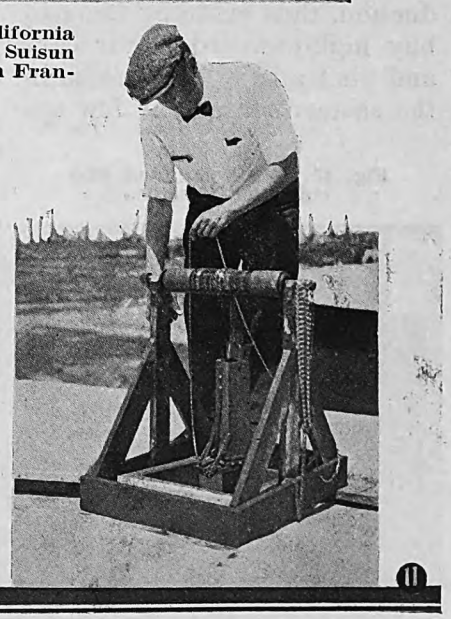


Fig. 11. An oil gauger with his "thief," used to take samples from a storage tank. With the tremendous increase in storage, the gauger's job has become one of the most important in the oil fields.

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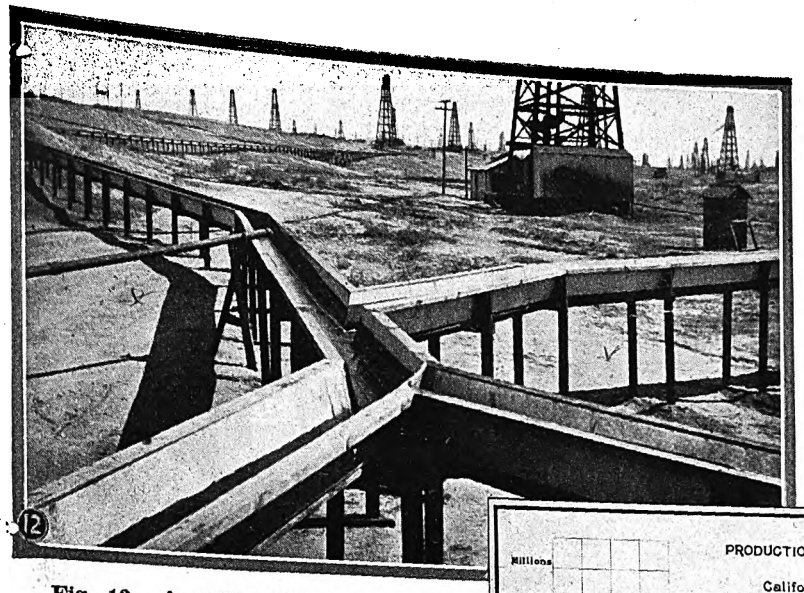


Fig. 12. A collection system of flumes used for wells pumping heavy oil and sand. Troughs are of sheet metal.

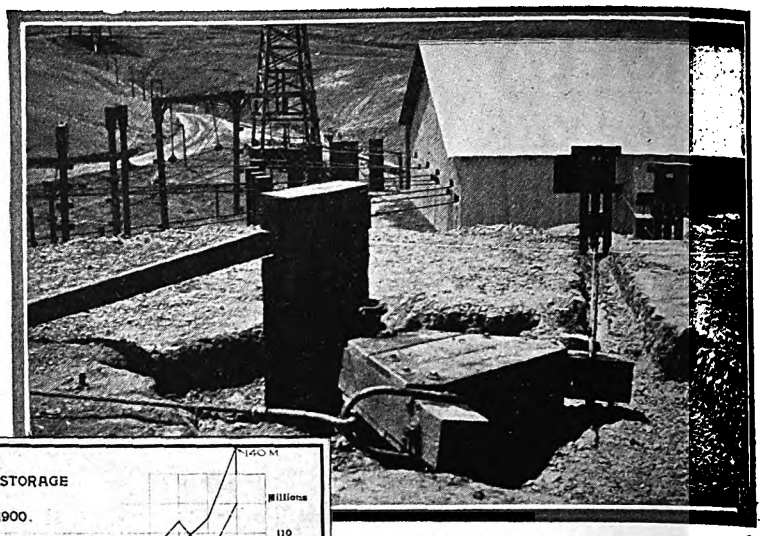


Fig. 13. A right-angle turn in a jack plant pumping cable.

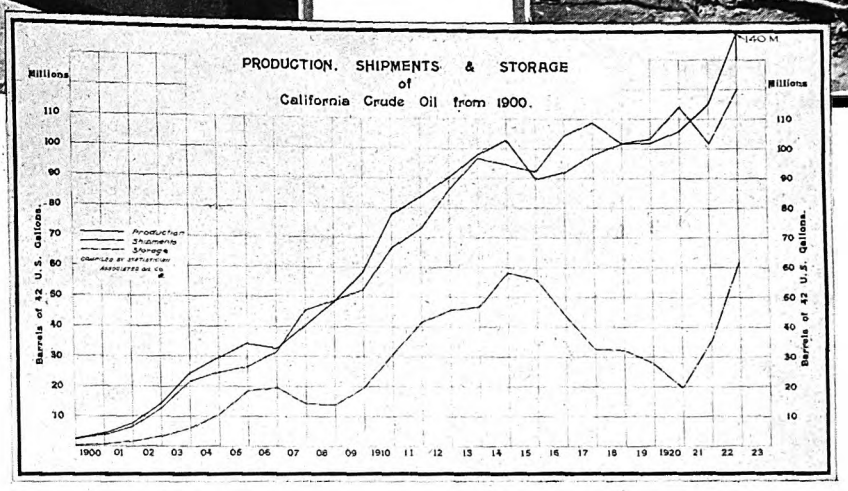


Chart of production, shipments and storage since 1900.

Although the adoption of such a type of organization required the investment of extremely large amounts of capital, and involved managing scores of small divisions of employees widely scattered over hundreds of miles of territory, it very greatly reduced the attendant risks of operation. While it is true that the owner of oil land has frequently been made wealthy by the discovery of oil, the corporation engaged only in drilling and oil production, can not in every case be said to have been equally fortunate. Where one man has amassed wealth through his organizing and executive genius, a score of others have lost everything in the oil gamble. Even in the tremendously rich Southern California fields, this has been more or less true. Numerous farmers and owners of town lots have sold their land for exorbitant prices, or have drawn large royalties from flush production, thus enabling them to buy high-powered motor cars and visit all the home folks in the eastern states. A few operators have done equally well, but not all have been so successful by any means.

Some of the problems of the early days in California's petroleum history may be typified by the events which succeeded the discovery of oil in the Kern River field, near Bakersfield, in 1899. The discovery well was drilled by a woodchopper named J. M. Elwood, who sunk a shallow shaft to a depth of seventy-five feet in the river bank. In a short time, the rush for oil lands resulted in drilling rigs being thickly scattered over a territory nearly five miles square. Many wells yielding as much as 500 barrels per day were soon completed.

In 1901, the annual oil production of California approximated 9,000,000 barrels. The wells drilled along the Kern River were capable of producing nearly twice that amount. The entire territory was owned by hundreds of small companies and by many private individuals, among whom there was no unity of action or purpose. Pipe lines were not available; the railroads had no equipment to handle that oil; and markets were still undeveloped. The price fell from about one dollar a barrel to figures which threatened the stability of the entire industry. Large contracts were made at twenty cents a barrel, and spot oil could be had for ten or fifteen cents.

Through the efforts of a small group of engineers and business men, a corporation was formed in October, 1901, known as the Associated Oil Company. In three or four years' time, nearly forty of the Kern River companies entered

(*Continued on page 65*)

Fig. 14. Water helps to float the oil to central tanks for separation from water and sand.

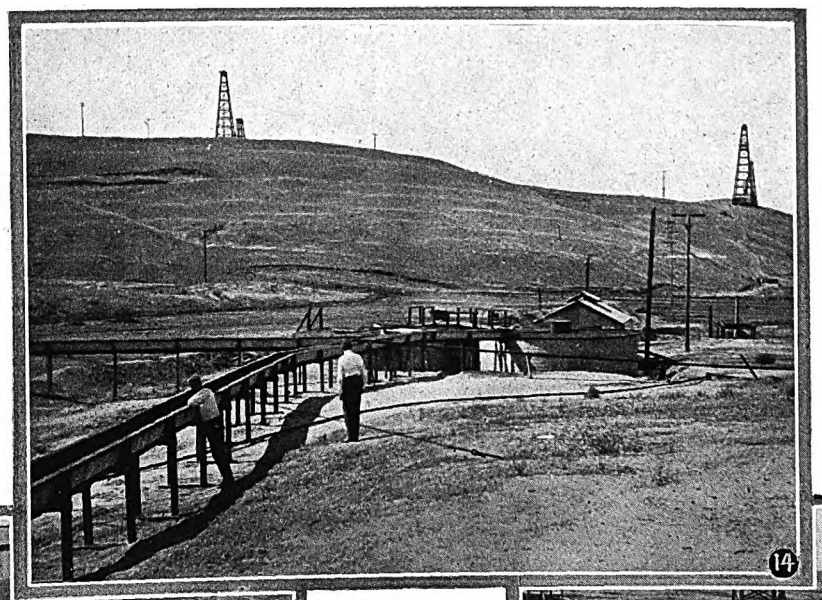
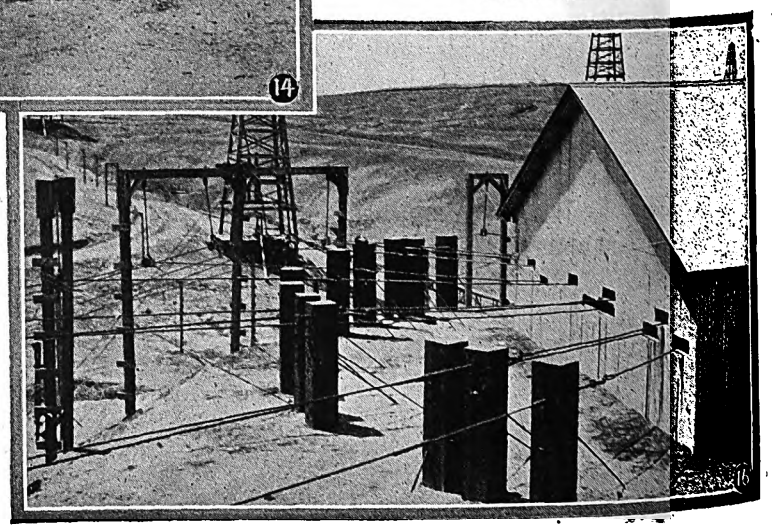


Fig. 15. Well pumping into collection troughs.



Fig. 16. A jack plant pumping several wells with one central power plant.



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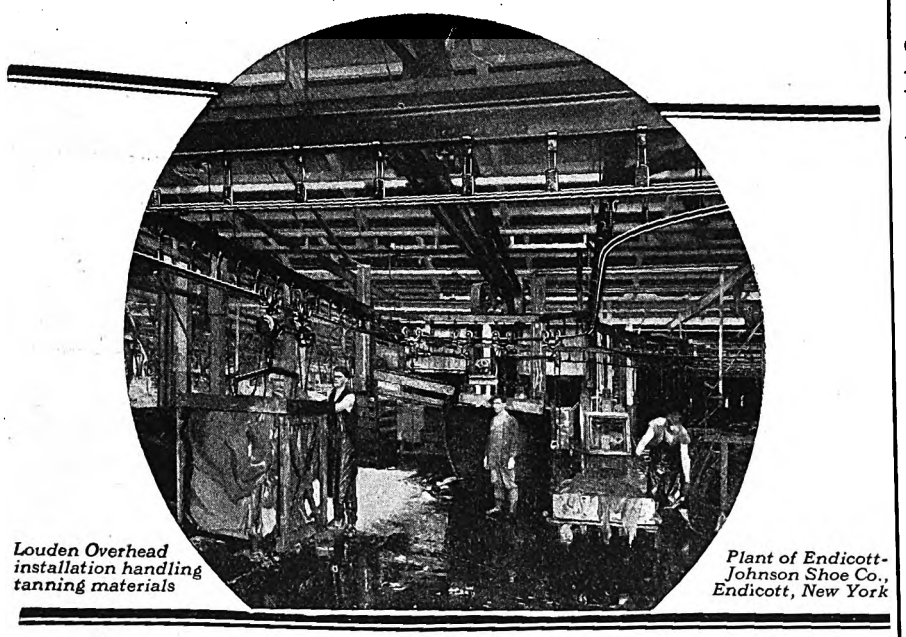
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ALBANY BOSTON NEW YORK PHILADELPHIA PITTSBURGH CHICAGO ST. PAUL

Making the Equipment Fit the Job

(*Continued from Page 12*)

er importance to the smaller plant.

Figure 10 shows a tiering truck holding heavy castings for the drilling operation. Those who are familiar with such operations as this will recognize the desirability of eliminating as much of the heavy manual labor as possible. If the machine attendants are relieved of a large part of the laborious lifting and handling, closer attention to the important details of the operation will be shown, and there will be less dissatisfaction and labor trouble. Satisfied workmen means decreased labor turnover, and reduction in rejected and scrapped products. The savings from this source alone frequently justifies the introduction of this equipment.

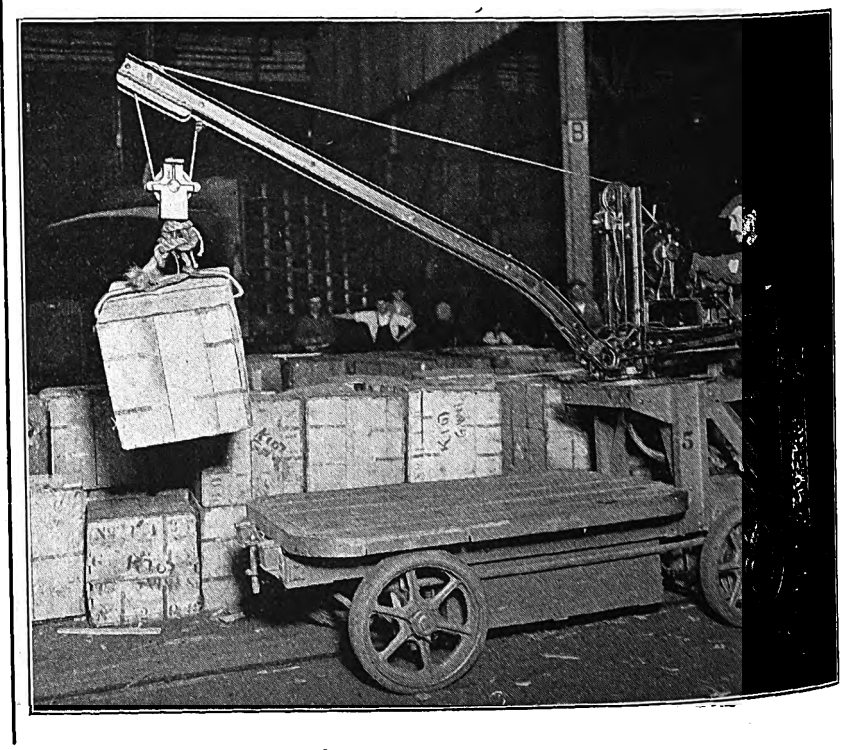
In the case of large machine shops, however, tiering trucks will perform more than this one operation. They have been found particularly adapted for changing dies in punch presses and drop forges. A large manufacturer in investigating the changing of dies in drop forge rooms, found that it required from two to five hours to change each die, and that under ordinary conditions, the operation usually required from three to four men. It was found that the annual cost, figured on this basis of changing one die per day, is as follows:

Four men for 3½ hours, at 50c per hour makes a total of $7 per day. Assuming a production value of $30 per hour for the drop forge, 3½ hours for changing dies meant a total loss of $105 per day, and when including the men's wages, the total loss was $112 per day. Figuring 300 working days, this made an annual cost of $33,600 for changing dies.

By installing proper racks for storage and a tiering truck, it is now possible to pick up, deliver and place any die weighing up to 4,000 pounds, in ten minutes. The cost of changing dies, with a tiering truck, allowing for production time, is approximately $5 per day, and figuring on 300 working days, the total cost is $1,500, making a saving of $32,100 per year over old hand methods.

Other operations upon which the tiering truck can be used are shown in figures 9, 10, 15 and 17, and in each case the saving was generally large enough to quickly pay for the truck, and show a profit during the first year's operation.

Loading motor trucks, where there is no loading platform, has always been a difficult proposition, but as shown in figure 14, it can now be simplified, not only making a saving in labor expense, but also a saving in idle motor truck time, waiting for loading and unloading. The piling of materials or placing them in bins,



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usually requires lifting and climbing. The trucks shown in figure 17 are an exceptionally high lift of tiering truck, the over-all lift from the floor to the bed of the platform in the maximum elevated position being eight feet. They have been found particularly efficient in this large stockroom, where thousands of packages are handled each day.

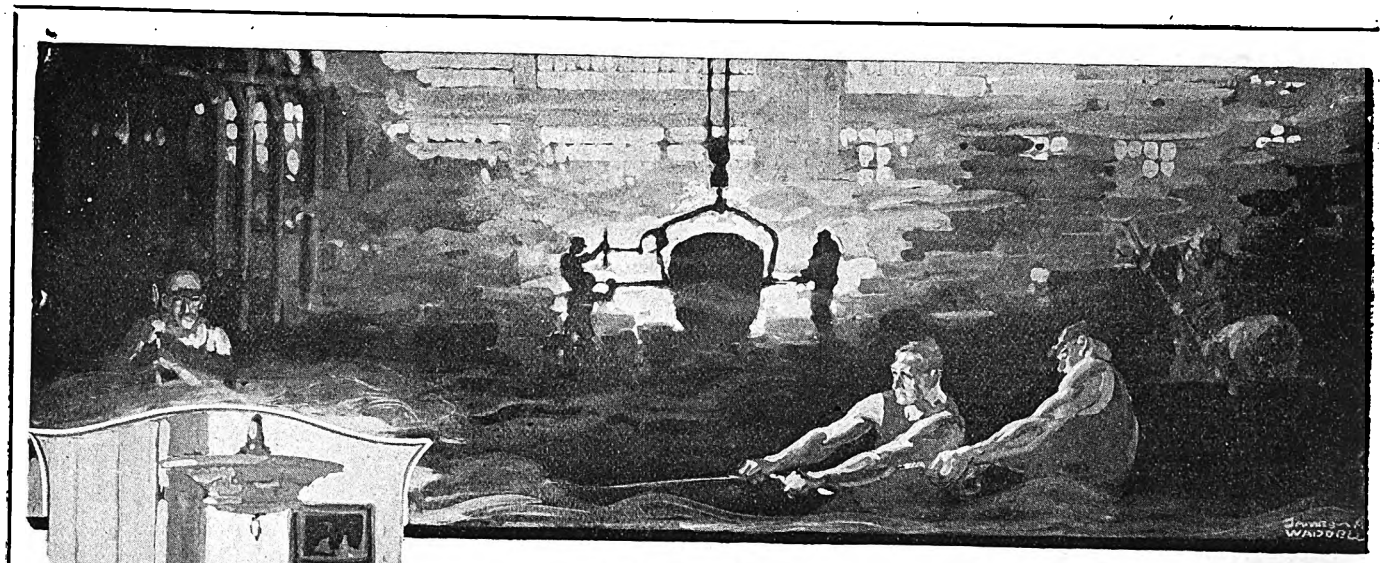
Figure 9 shows a tiering truck tiering bags on steamship docks, raising the loads 70 inches from the ground. This truck also transports the load from ship side to pile. When using tiering trucks as transporting units and for general hauling, care must be taken to see that the uprights are low enough to clear all doorways, and the operators should be instructed not to make long hauls with the load more than eight inches or ten inches from the floor. The method of operation is similar to that of ordinary elevating lift trucks with platforms and skids.

The advantage of lifting materials to given heights has caused a number of adaptations or attachments to be applied to the tiering truck principle. Figure 8 shows a special short wheel-base truck, with a special platform or attachment, which has proven very advantageous in chemical plants. The arms are arranged to handle cylindrical or square packages. When changing from one to the other, it is only necessary for the operator to raise one set of fingers, and the other set automatically comes down in position. This is accomplished by the use of a quadrant set of gears as shown. The load can then be raised to the height of the uprights for charging vats, kettles, etc.

The use of arms and fingers on special trucks shows the tendency for mechanical equipment to imitate the human being, and the reason for this is that the human system is so constructed that it is adapted to handle practically everything. It is not surprising therefore, to see so many different types of finger trucks on the market. One of the newest models is the development shown in figure 16. It embodies the particular feature of being able to pick up its load without the use of platform skids, and in addition, allows for the stacking of units without the usual waste space of 12 to 14 inches which is incident to the tiering of loads on platform skids.

A truck of this design is now being used for handling sheet tin, and is performing an operation which would otherwise have been carried on with old hand methods, as the use of platform skids for carrying the load into the freight car called for so large a quantity that the investment charged wiped out the considerable savings otherwise effected. The loads are now placed on 2″ x 2″ strips, thus eliminating the skid investment. The tin is placed on these strips in the car at the mill, and a similar truck unloads the tin at the plant, and stacks it in 2,000-pound units, three high. An operator and a helper can unload a 30 to 40-ton car in about an hour and a quarter.

The application of this unit to other commodities is possible, with the attendant saving of the investment in skids.

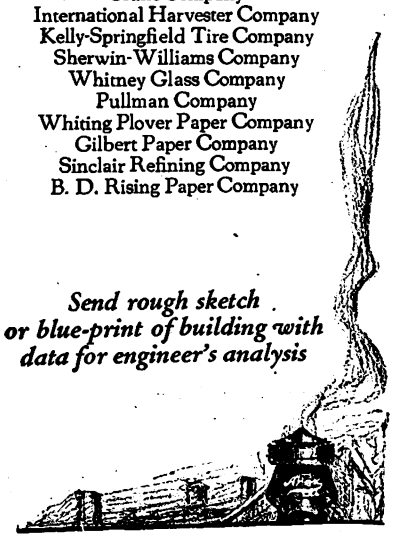




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This is only one of the many small attachments that can be placed on standard equipment to make the equipment fit the job. There is practically no industry in which some type of special truck cannot be used, and the manufacturers are willing to assist in making the equipment fit the operation. Frequently this special equipment which is designed for some particular problem becomes so universal in use that it is shortly considered as standard. Such is the case with the dump body trucks, as shown in figures 1, 21 and 22. This equipment is gasoline driven, and can also be used as a tractor.

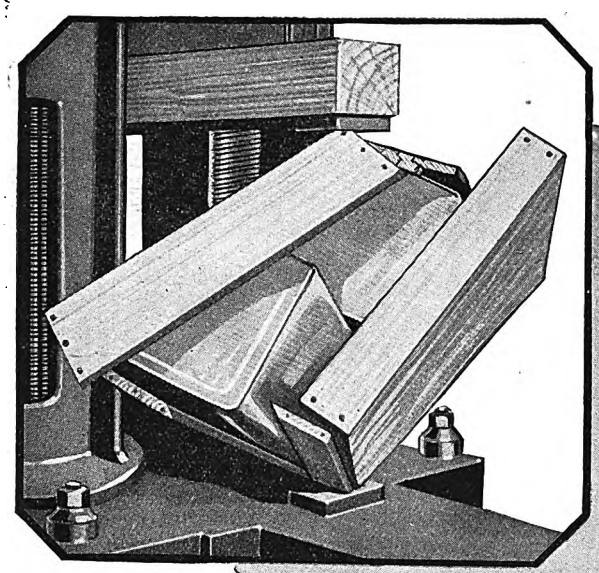
Figure 1 shows how the Arcade Malleable Iron Company, Worcester, Mass., by installing a hand hoist dump body truck, replaced 8 wheelbarrow men in the hauling of coal from storage pile to power house. There are many places where it is impossible to install conveyors, but the use of a dump body truck will make a saving and better operating conditions in the handling of bulk materials. An illustration of this is in the handling of coal in brick yar etc., as shown in figures 2 These photographs were t in the Globe Brick Compa plant at East Liverpool, O and show the method of ha ling coal from the track hop to the kiln. A second truc also used for handling cind bats, and other refuse to dump. The placing of a la gate handle, where it can ea be reached by the driver of truck as shown in figure makes it possible for a man do his own loading, and as truck is automatically dump there is no need for assistan when unloading it. This co pany now employs two men one for each truck, and th handle all the material. I coaling, the average monthly tonnage handled, is approximately 2,000 tons. For the above tonnage, and for handling cinders and refuse, their expense for a 30-day month for men, mules, carts, etc averaged $930. With the two dump body truck tractors, the expense for a 30-day month averaged $403.10. This represents a saving of $526.90 per month, over the old methods. They figured that the equipment paid for itself in the first 8 months, and that they are now making additional savings.

The saving of man hours, or, in other words, money, was the first reason for installing materials handling equipment, but now consideration is being given to operating conditions, and to the laboring man. At one time there was no more disliked job than the placing and removing of pots in annealing furnaces. These pots were very heavy in some instances, and considerable time was lost in allowing them to cool, so as to make it possible for men to handle them. Now, an electric truck called a furnace charger does this work quickly with less effort to the men and at less expense, and handles the pots when they are still red-hot, frequently operating in a temperature as high as 750° F.

Figure 6 shows such a device, and in the plants where this type of equipment is being used, they are dubbed by some the "foundry alligator" and by others the "big cockroach"

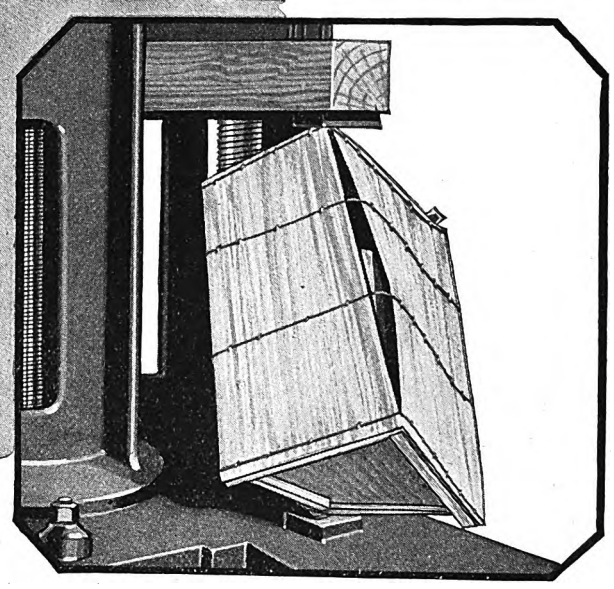
(Continued on page 32)

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SPECIFICATIONS
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Ends	3/16 in.
Maximum Load	1,763 pounds
Lumber 50%	Strength 180%



SPECIFICATIONS
Nailed Wood Box

Sides, top and bottom	3/8 in.
Ends	3/4 in.
Maximum Load	957 pounds
Lumber 100%	Strength 100%

These illustrations are reproduced from photographs of box tests made under the supervision of the United States Department of Agriculture at the Forest Products Laboratories.

WOOD boxes and crates are recognized as the strongest practical containers. A box made of any other material and in general use would have failed in this diagonal compression test long before the nailed wooden box did at 957 pounds pressure.

But the Pioneer Wirebound Box, using less lumber and weighing one-half as much, withstood a pressure of 1783 pounds.

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Our box Engineers will be glad to study your requirements without cost or inconvenience to you. If you cannot use Pioneer Boxes or Crates they may be of help to you in other ways. We make all types of wooden shipping containers. A bulletin on boxing and crating —"General Box Service" —will be sent free upon your request.

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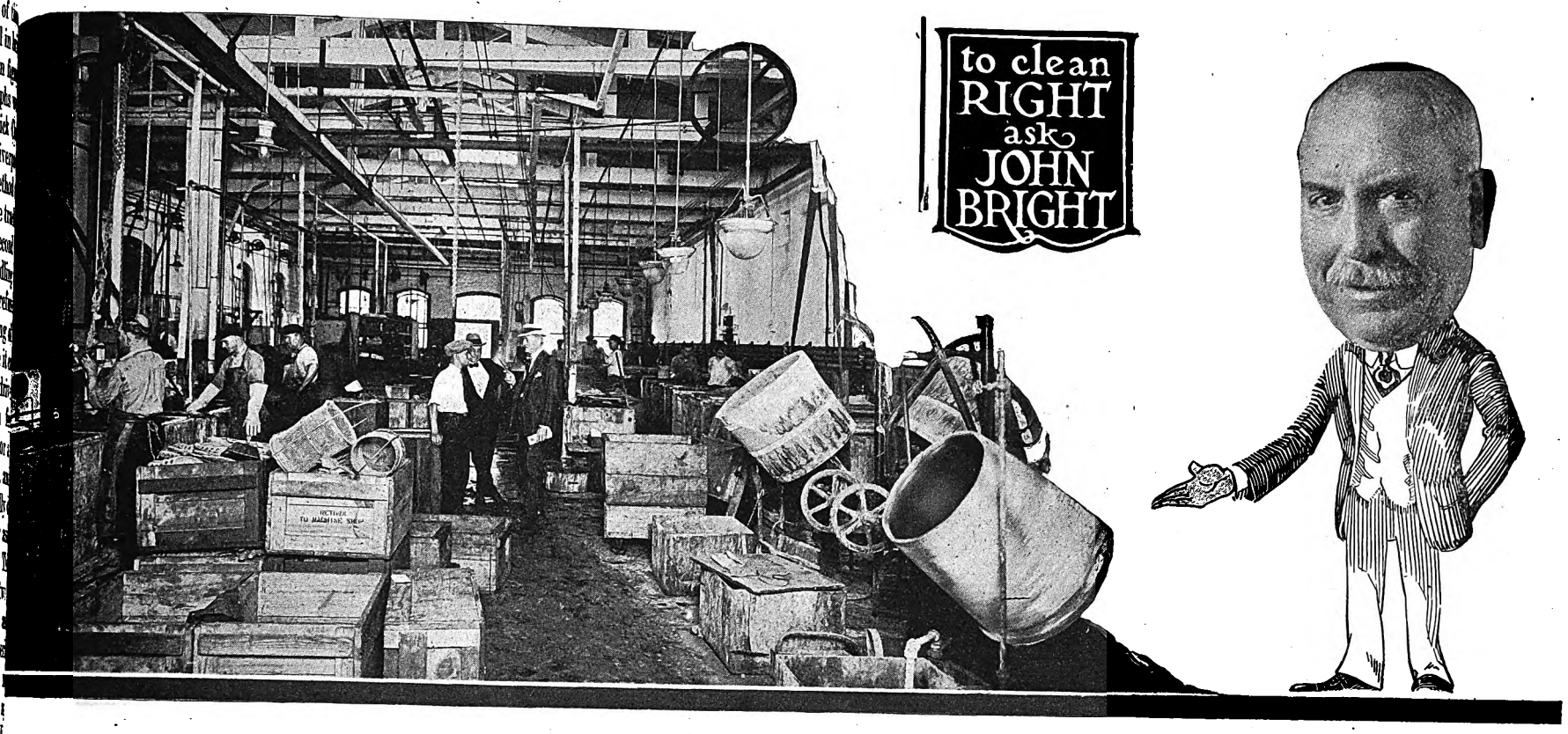
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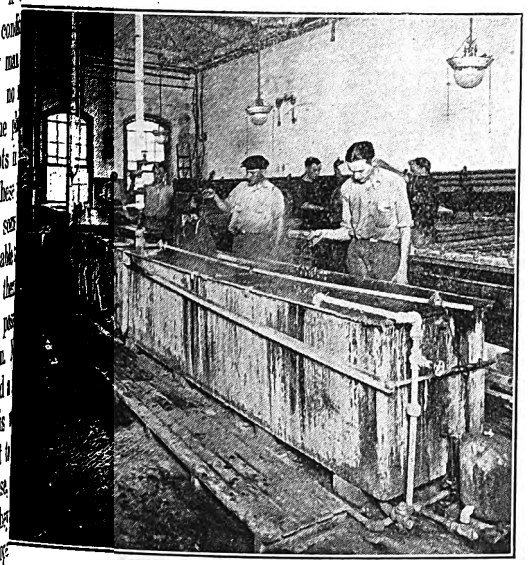
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Give me a chance to show you what I can do. Fill in the following technical report and I'll do the rest.

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Please send me a trial lot of the proper cleaner together with full directions covering its use. Send me complete information :.....
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International Products
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INTERNATIONAL CHEMICAL CO.

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(Continued from page 30)

because of their shape, and the speed with which they dart about the plant. This machine is employed principally in handling six to eight thousand pound pots of castings in and out of the annealing furnaces. It will be noted that the truck, figure 29, is equipped with herringbone steel wheels at the front end of the truck, while the one in figure 30 is equipped with rubber-tired wheels. This is purely a matter of preference, as the rubber tires stand up quite satisfactorily under the high temperatures, although the maintenance is slightly greater than if they were not subject to this heat. The equipment is very well protected from the dust and heat usually found in places where it is necessary for them to operate.

In one large plant, four of these furnace chargers pick up, haul and place 25,000 tons of foundry material every 24 hours. It has been found that 100 tons of finished castings require four tons of pots and packing, and that each stack of pots requires five handlings. This tonnage is equivalent to that transported by a freight train of fifty 50-ton cars, and yet the total cost for electric power to perform this enormous task is just $4.00 per day.

To make another comparison, or express the above in other words, it has been found by observation that two operators, with two furnace charging trucks, can move 900 stacks of pots, weighing 3,000 pounds each; 480 stacks were transferred 300 feet, and 420 stacks were delivered a distance of 80 feet, in just five hours, and 15 minutes. Compare this with any other method of handling pots and remember practically no change in present foundry layout was required when installing this equipment.

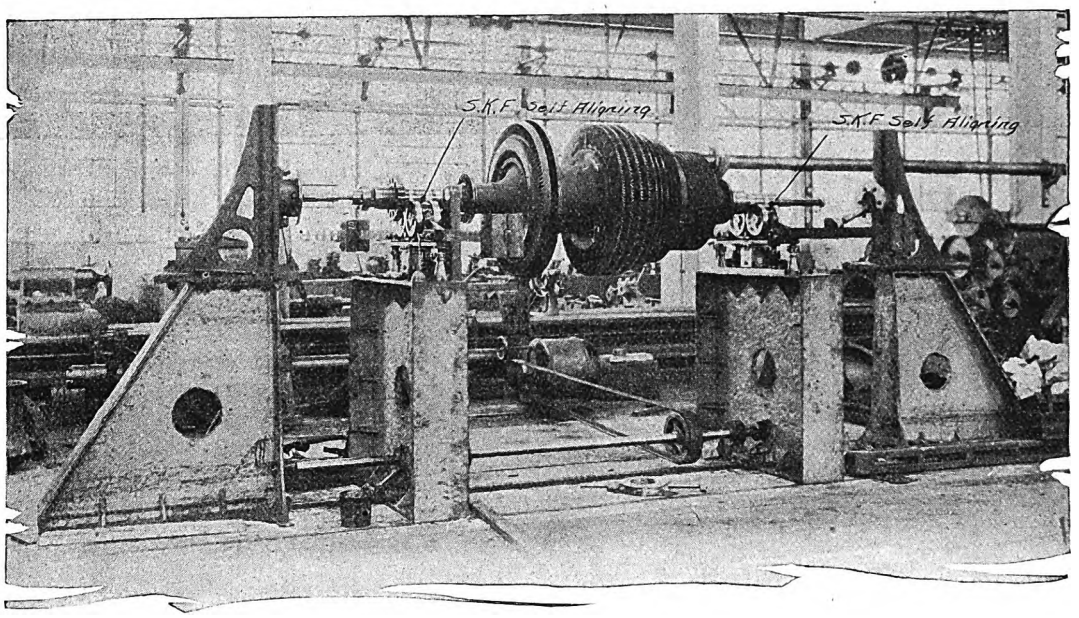
These trucks are not restricted to work at a given spot, but may be driven anywhere. The operation of the furnace charging truck is very simple. The front end is equipped with a pair of fingers which slip under the load and then the operator starts the motor, which tilts the load so as to carry it in a slightly inclined position. When unloading, the operator runs the truck to the point where he desires to place the load, and then starts the motor again, which permits the load to come into an upright position, and by backing the truck withdraws the fingers from under the load, and proceeds to the next pot.

The furnace charger truck shown in figure 30 is handling skid loads of raw materials about the yard. While special skids are required due to the height of the lifting mechanism, there is no reason other than the unwieldiness of the equipment, why it should not be used on this operation, when it is not kept busy handling pots at the annealing furnaces.

There are many unwieldy packages which are odd in shape and difficult to handle, but special trucks, such as those shown in figures 4, 5, 7, 23 and 24 are now handling this class of material with ease.

Figures 2 and 3 show the method of handling automobiles packed for export before the special trucks shown in figures 4 and 5 were installed.

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UNLESS massive, high-speed machinery is in dynamic balance serious vibration occurs and causes quick destruction of the machine elements.

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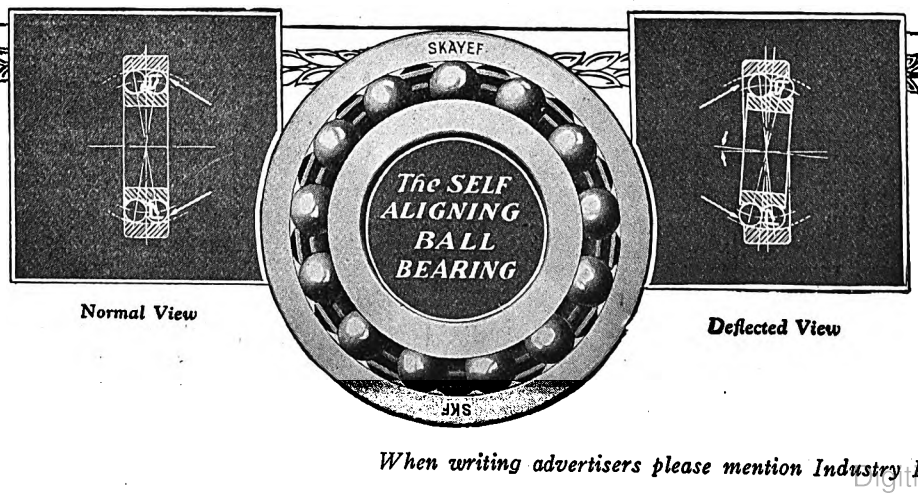
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The use of ball bearings for the delicate dynamic balancing of heavy rotating parts is indicative of the freedom from wear and vibration that accompanies their use on the common machines of industry, transportation and science where they also effect substantial power savings.

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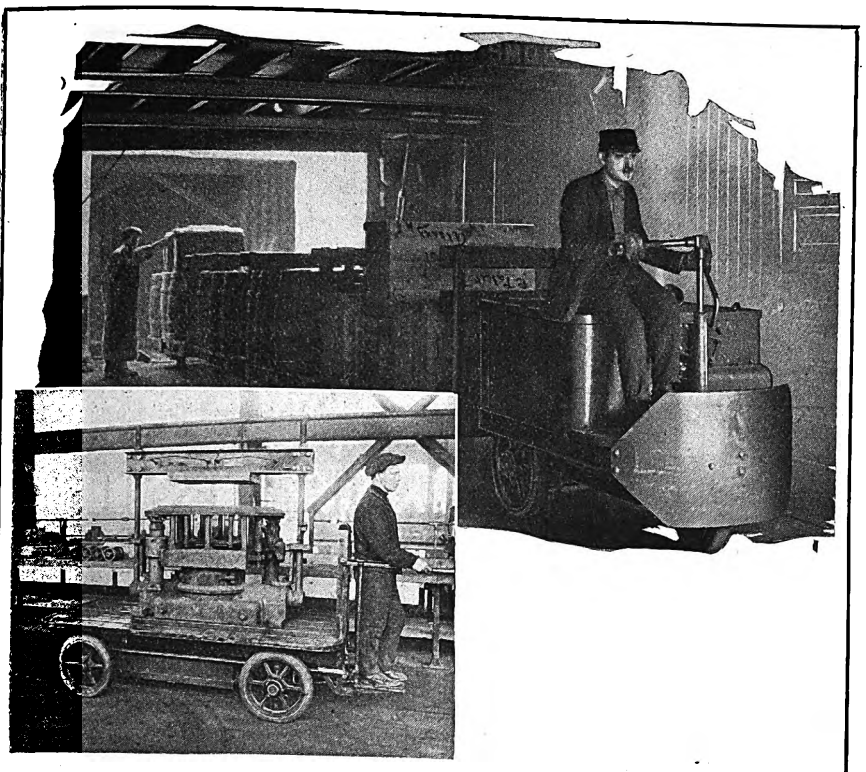
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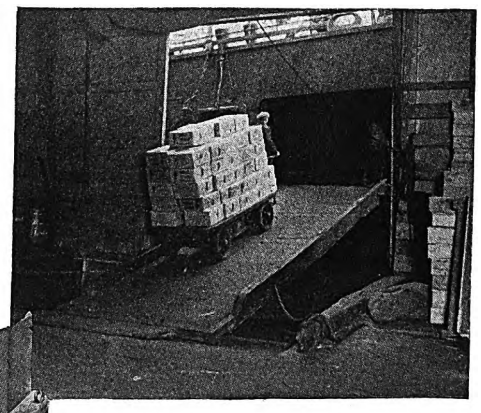
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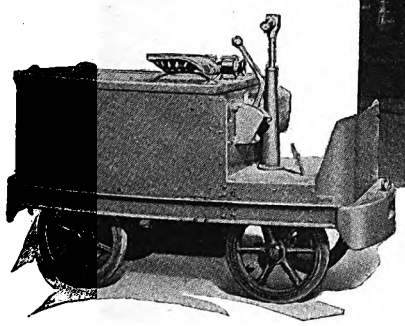
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CRESCENT TRUCK CO.
165 No. 10th St., Lebanon, Pa.

Over 200 CRESCENTS operating in the following ten industries:

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American Sugar Refining Co.
Bethlehem Shipbuilding Corp.
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CRESCENT TRUCKS TRACTORS

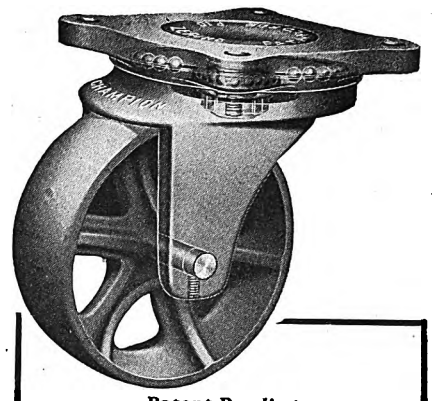
CRESCENT
ELECTRIC TRUCKS & TRACTORS

It will be noted that it required 9 pier laborers to load these packages on hand trucks, and it required 8 men to move them along the pier. Now the entire operation is handled by two men and two trucks, quicker and cheaper. These trucks are standard pieces of equipment fitted with the attachment which is shown at the front of the truck. The two illustrations show the method of operation. The trucker runs the fingers under the load, and then elevates them, raising the load off the floor for transportation. In the case of smaller packages, the fingers on one truck are run under the load, and a chain is thrown over the package to hold it in position, the operation after this being the same as in the case of larger packages, namely, elevating the fingers, which raises the load off the floor.

The equipment shown in figures 23 and 24 is a standard electric storage battery truck, fitted with a special carrying frame, which is capable of handling rolls of paper, boxes, and other loads of similar size and weight. A flexible band holds the load in position, and because of its flexibility, it will grip any shape package. Both these loads are bulky and difficult to handle, and would require several men if performed with common hand methods. These illustrations should quickly point out the advantage of handling unwieldy packages and transporting them by mechanical, instead of man power.

Crane trucks are built in many different designs. Some of these trucks are equipped with short booms, others with long booms, and some are even equipped with sectional booms and outriggers, so as to permit the lifting of loads over a large radius. Some of the trucks carry the load suspended from the hook, figure 9, while others are mounted on trucks, which permit the load to be carried on the truck platform, figure 20. In this case the crane is only used for loading and unloading. Some of the crane trucks have the crane boom and battery box mounted on a pivot as a single unit; with this construction it is possible to swing the boom in a complete circle, figures 18, 19.

The crane truck has been particularly successful in ma-



Patent Pending

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The new Champion Double Race Caster is the greatest step ahead in caster construction. It is a real time and money saver. When ball races become worn, it is only necessary to adjust the nut in center of fork—no need to pull truck apart—no new casters necessary.

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chine shops, locomotive works, foundries, and in operations where cumbersome packages have to be raised and lowered, as well as transported. It is very simple, frequently, to pick packages up in some form of sling, where it would be impossible to handle them in any other manner.

There has always been a great deal of expensive labor and much danger attendant to the handling of newspaper rolls, which run anywhere from 1,500 to 2,000 pounds each, these rolls averaging in length from 32 to 72 inches. In the average plant, the up-ending of a 72-inch roll is a task which follows the placing of the wrapper around the roll as soon as it leaves the machine. This usually requires one man standing at the end with a stick thrust into the core hole, and two others lifting with him half the weight of the roll, in order to up-end it on to a cardboard end paster. After this operation, these rolls must again be laid down before being transported into a car. They are usually rolled or handled on some form of hand truck. The truck shown in figure 25 will pick up a roll from a horizontal position, carry it on the truck, stand it on end, or lay it down as desired, or it will pick up a roll from a standing position, figure 26, and deliver it, setting it up on end, or laying it down, as required.

The entire cycle of operation is accomplished by means of a very ingenious device all of which is actuated by a single cable from a single drum hoist, located in front of the battery box. This is a very simple method, when considering the great number of functions the unit performs. When it is desired to stack two or three small rolls, one on the other, end to end, it is only necessary for the apron of the truck to be thrust beneath three of these rolls in a row, whereupon it will immediately revolve them into a vertical position, standing them up.

Another make of truck to perform the same operation, is shown in figure 27 and 28. Several of these trucks are in use at the plants of one of the large paper mills in the United States, where they have saved thousands of dollars annually. before installing the trucks, the large 72-inch paper rolls were handled on a 24-hour a day basis, by seven men per shift, these men operating for finishing, up-ending and trucking, five men being actually used for up-ending the rolls. With the use of this truck two men are now used per shift, for up-ending and trucking to the shipping department. Both men are finishers, one finishing and driving the truck, the other finishing and heading the roll.

Here, then, an initial saving of five men per shift has been effected. In dollars and cents, this means a saving on a 300-day basis, of over $21,000 per year. There is also a material saving in time of handling the roll, and the greatest saving by far is in transportation, to say nothing of taking the heavy manual labor off the men. The truck can be used for either lifting the roll from a horizontal position or from a vertical position. The illustration herewith shows a truck handling a large roll in a horizontal position. One of the distinct features of the truck is that when the lifting arms



Starting and Speed Regulating Handles are exterior-operated.

The arrow points to the C-H Overload Relay which eliminates fuse troubles.

The Starting Handle at right can be locked open to prevent unauthorized persons from meddling. The case can be locked also.

Better Appearance

All Switch and Control Parts in One Safety Enclosure

Besides the safety, there is an added advantage in having one device include the *starting or speed regulating controller, the overload protection, and switch for line connection.*

It is a step in advance in construction and particularly so where appearance counts, as in office buildings, hotels, public buildings, and even in factories. These Controllers are not fancy, high-priced switch-board types, but are built along practical standard controller lines. Installation expense is reduced, there is less wiring—fewer conduit fittings. Maximum protection of motors is provided at the smallest cost.

C-H *Overload Relay* *Saves Fuse Troubles and Expense*

The delayed action of the C-H Overload prevents unnecessary interruption on temporary overloads but provides full protection against injury to motor. The time required and the expense of renewing fuses is entirely eliminated.

The enclosing cases are dust and moisture proof—safety is insured because all parts are concealed. Manually operated and automatic types are made in both alternating and direct current types.

THE CUTLER-HAMMER MFG. CO.

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In developing the complete line of standard enclosed circuit breaker type starters and controllers Cutler-Hammer engineers incorporated the latest ideas in controller engineering design with such ideas dictated by the requirements of leading engineers and architects—the Electric Power Club, National Electrical Code and other safety codes.

C-H CUTLER-HAMMER **ENCLOSED CONTROLLERS**

BUILDING EQUIPMENT TYPE

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come together on the roll with sufficient pressure to lift it, and note here that this is not a crushing pressure, the lifting mechanism automatically elevates the roll. The adjustment of the truck is so regulated that it can be manoeuvered up to a roll so as to eliminate any possibility of breaking the edge of the roll while lifting.

Many warnings have been sounded regarding the shortage in the common labor market, but there are still some executives who have not fully realized the seriousness of the situation. Other executives have, however, felt the need of supplementing man power with mechanical equipment, but quite frequently the handling of certain classes of materials mechanically is considered impossible, because the executives are not familiar with the different types of special equipment that have been developed, and they are reluctant to spend the money to design and develop special equipment to fit their needs. A number of materials handling representatives overlook, or do not know of the many ingenious devices that have been added to standard equipment, or do not push the special designed equipment which is now successfully performing mechanical operations that have always been considered as necessary evils, to be performed by hand labor.

There is also a tendency on the part of some executives to feel that a truck that has been designed particularly for the foundry industry, or for the chemical industry, cannot be used in the textile industry or paper-making industry. This attitude is costing industrialists thousands of dollars each year. Frequently by merely making a slight change in some part of equipment that has already been designed for a particular job, it is possible to adapt this same equipment to several other operations. The executive should not consider that because a truck is called a tiering truck, that it can only be used for piling materials, but he should look at this equipment, and see if it is possible to slightly alter it and use it in many places throughout the plant.

The secret of successful operation of any mechanical equipment is to keep it constantly busy, and because of this it is necessary to provide each piece of equipment with all the accessories or attachments that can be used on various operations throughout the plant. For instance, a tiering truck can be equipped with a roller platform, as previously mentioned, for handling dies, but as this operation will not require the full use of this truck, it could at the same time be provided with a dump body skid, or a series of dump body skids for handling refuse.

In addition, the same truck could be used for transporting and tiering materials in the warehouse.

A crane truck should be provided with all types of slings for handling all classes of materials, and when purchasing the truck, the boom should be given every consideration, so that it will fit into a number of operations through the plant.

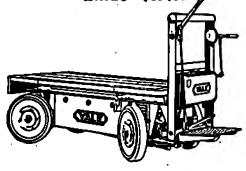
In the case of the furnace charging truck, it is best to keep it active on the particular work for which it is designed.

(*Continued on page 37*)

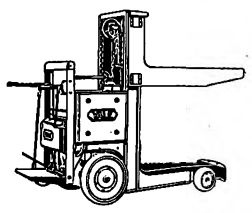
YALE—the key to lower handling costs
Chapter 2 on Storage Battery Trucking



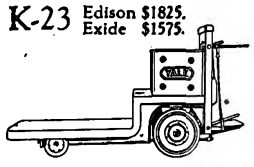
K-20 Edison $1825. Exide $1575.



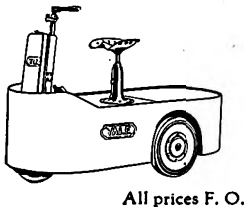
K-22 Edison $2350. Exide $2100.



K-23 Edison $1825. Exide $1575.



K-24 Edison $1925. Exide $1675.



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The Yale policy involves:—*education*, to awaken a greater general appreciation of mechanical material handling economies; *analysis*, to determine in your plant your specific requirements; *recommendation*, to present for your consideration the findings of experienced engineers; *demonstration*, to satisfy you definitely as to the economy of industrial truck transportation; and *service after sale*, to insure the highest standard of efficiency in your system.

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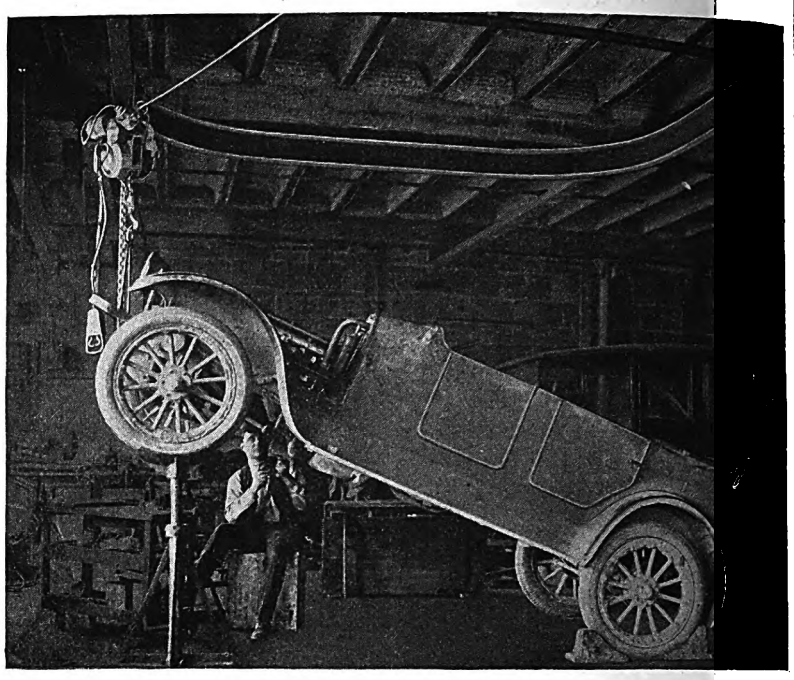
The new Mogul Type **Reelite** is a big brother to the thousands of **Reelites** in use today in industrial America. For years, wherever portable cords are used, these **Reelites** have kept them reeled clean and unkinked—off the floor, away from the wheels of trucks and the heels of workmen.

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THE *MOTOR-DRIVEN* CHAIN HOIST



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¼ to 10 tons.

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The Motorbloc is portable. It can be hung up like an ordinary hand block in any location where electric current is available, and put in service with the facility of an Electric Drill.

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"Enables one man to do the work of a gang."

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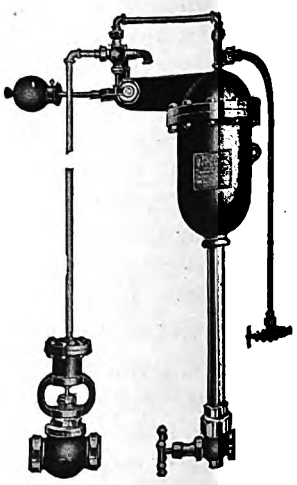
Their use insures drier steam, increased boiler capacity and greater fuel economy.

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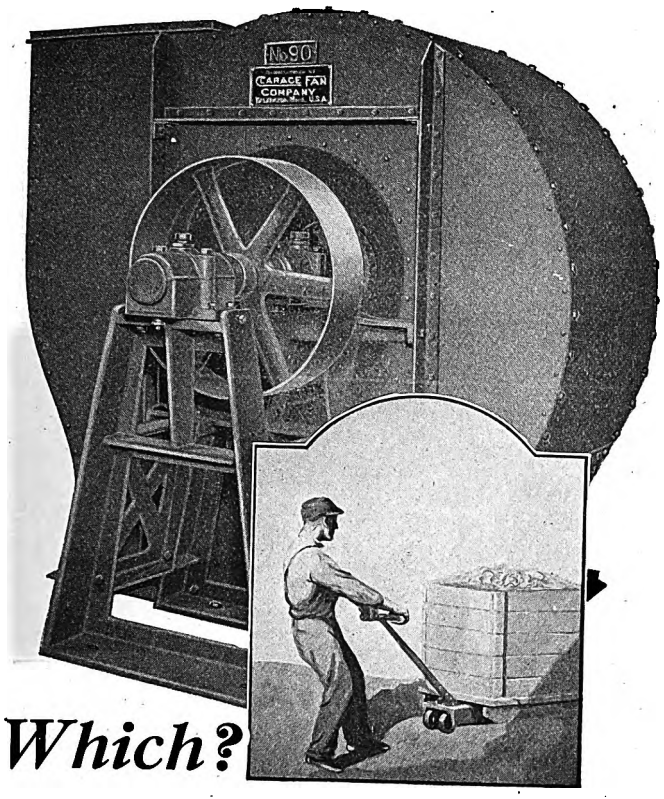
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A large Clarage S P Fan specially built for heaviest service.

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FANS~BLOWERS~EXHAUSTERS
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Clarage Fans are built in types and sizes for every service.

(*Continued from page 35*)

Some plants who do not have enough of this special work have found it profitable to use special designed skids for handling raw materials in the yard. In this case the furnace charging truck is used the same as the lift truck, but it is rather unwieldy to handle on such work, due to its excessive length.

The paper truck is so special that it is doubtful if it could be used for handling any other class of material, but by making slight changes in the design of the carrying end, there is no reason why the same principle could not be used for handling materials in other industries.

The plant executive who is anxious to reduce his production costs should keep in constant touch with the new equipment that is being developed in the materials handling field. This applies not only to trucks, but to conveyors, elevators, hoists, monorails, cranes, etc., because there are many new developments being brought forward each year.

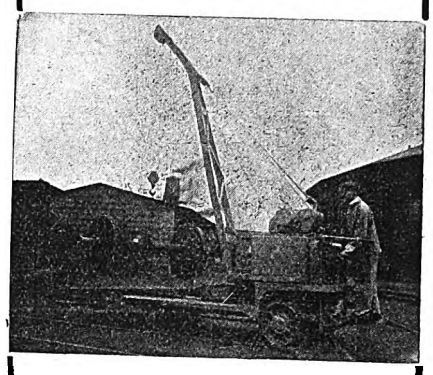
The laboring man of today is not so anxious to exhibit a large amount of bull strength as was the case ten years ago, and frequently because the work is heavy, they have a tendency to idle on the job. It is a well known fact that as people become educated, they think less of doing manual work, but there is no need to waste this education, or to restrict it, and for this reason the laboring man should be supplemented with as much mechanical equipment as possible, so as to remove the drudgery from his work, and at the same time permit the executive and the industry to realize a profitable return on the investment.

The installations described in this article show only a few of those which are now operating, and in each instance, the money savings are enormous, but as previously pointed out, it is not only the saving of money and a conservation of labor that is causing the installation of mechanical equipment, but it is the tendency of the progressive executive to make better working conditions in return for which he reduces labor turnover and labor trouble.

There is no doubt but what

(*Continued on page 39*)

ELWELL-PARKER



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Time has nearly passed for choosing.

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Electric Industrial Trucks and Tractors
are available now
but common labor is not.

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lift, carry, and place the loads where wanted.
They will deliver eight times the load at three times the speed of a hand trucker.
They are always ready, work early and late. Many operate 23 hours per day.

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Thousands in operation in over 200 branches of industry in 23 different countries. Tried and proven equal to every inside haulage requirement. Many have been in continuous service for over 10 years.

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trucks are guaranteed to save from the very start.

SELF-LOADING TRUCKS
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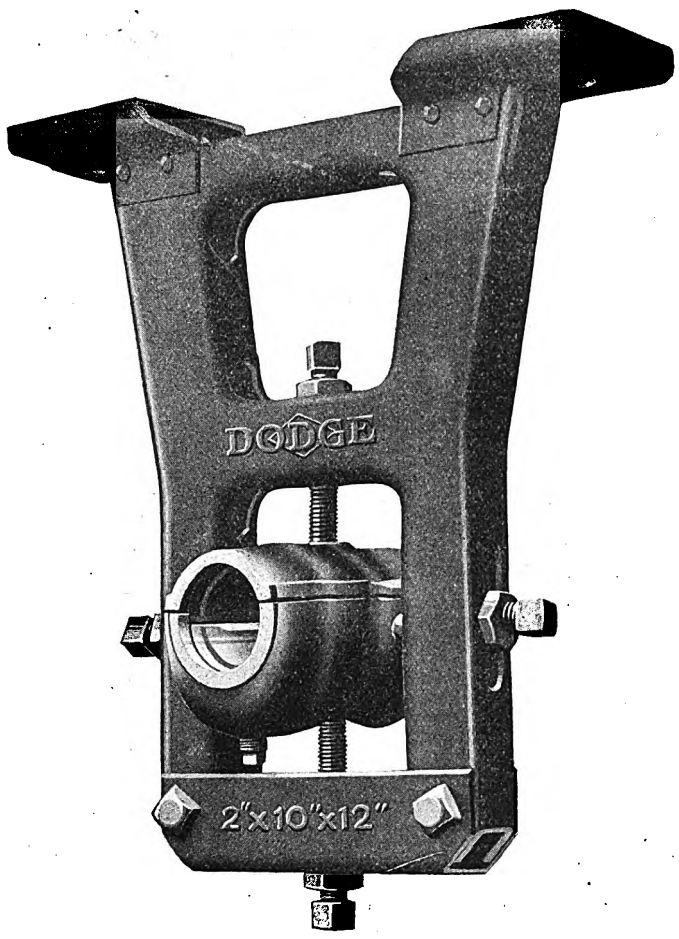
Our unobligating survey is yours on request, or ask for Bulletin 51.

ELWELL-PARKER
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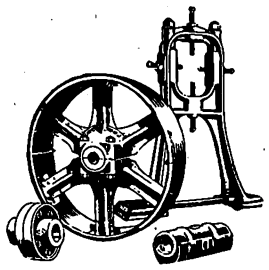
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CANADIAN PACIFIC RAILWAY

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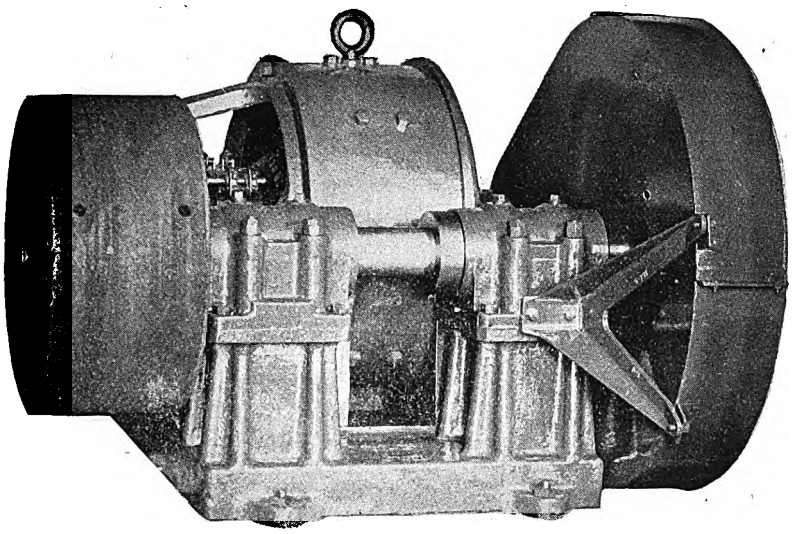
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WATSON-FLAGG

REDUCTION GEAR DRIVES

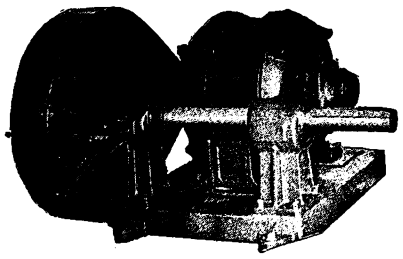


170 rpm on this pulley without the use of countershafts or special slow speed motors.

The above unit drives a clay mixer in the new plant of the Columbia Steel Co., Springville, Utah. It comprises a Reliance Heavy Duty, type T, 30 HP, 850 rpm Direct Current Motor equipped with a standard W-F Reduction Gear Drive. Gear ratio of 5 to 1 through silent pinion gives a Back Shaft Speed of 170 rpm.

This equipment is subject to extremely heavy starting conditions and continuous severe service so commonly met with in steel mills, under which only the most rugged equipment stands up.

STANDARD APPARATUS WITH THE BETTER MOTOR MANUFACTURERS



AVAILABLE FOR ANY MAKE OF MOTOR

Ask your Motor Manufacturer

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WATSON-FLAGG

ENGINEERING COMPANY

PATERSON, N. J.

(*Continued from page 37*)

this country will always be more or less faced with a labor shortage, particularly in the field of common labor, and it is therefore a necessity for the progressive executive to become thoroughly familiar and conversant with all forms of materials handling equipment. There are a great many machines nowadays which are considered standard, and which have been so highly developed that it would be difficult to perfect them further, but there are a number of operations that these standard machines cannot perform. Frequently by slightly altering the nature of the work, the standard equipment will handle it, but in other cases, to change the nature of the work is impossible, either due to precedent or to plant construction and operating conditions. The field of materials handling equipment has now become so large that it is not necessary to make the job fit the equipment, because the equipment can easily be designed to fit the job.

While the most optimistic expectations regarding the stimulus which the fall trade would impart to general business have not been met in September, some quickening of activity has appeared. The reductions in forward buying during the summer months contributed to the maintenance of generally conservative inventories and have necessitated new buying for the replenishment of stocks. A continuation of moderately good business in the immediate future is indicated.

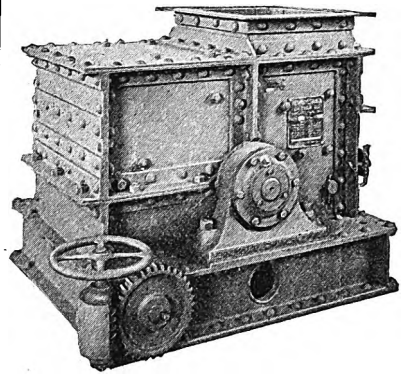
The recession in average commodity prices has been arrested, and in August and the early weeks of September advances were recorded.

There have been only moderate seasonal advances in money rates, and the credit resources of the banks are ample to meet all the requirements of fall business without strain.

The resistance of business and finance to a succession of untoward circumstances, such as the threatening aspects of the controversies between Italy and her Balkan neighbors, and the disastrous earthquake in Japan, further attests the fundamental strength of the domestic situation.

(The Guaranty Survey)

"PENNSYLVANIA" CRUSHERS

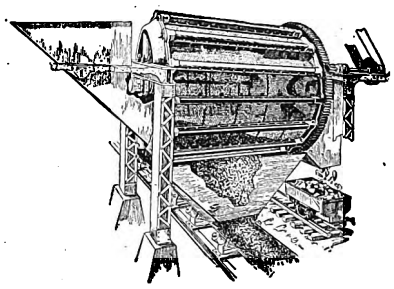


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For Coal, Lime, Limestone, Shale, etc.

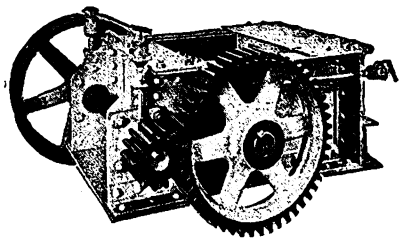
(a) Unbreakable Steel Frame
(b) Quick Adjusting Cage
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BRADFORD BREAKERS

31 Sizes

Crushes and **automatically cleans** and prepares Stoker Coals, By-Product Coals, Gas House Coals and reclaims "Gob" coals. BREAKER UNDAMAGED BY TRAMP IRON.



SINGLE ROLL CRUSHERS

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For Coal, Lime, Limestone, Shale, etc. A remarkable Preliminary Crusher.

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Why the Superheater?

(Continued from page 17)

form of a gas. As soon as it has been partially condensed its usefulness for developing mechanical or electrical power has been proportionately reduced. Naturally the ideal condition occurs when the steam leaving the engines or turbines has given up sufficient heat in the production of work so that it is just at the point of condensing.

If the steam generated by the boiler is dry saturated, however, this ideal condition cannot be realized, owing to the condensation losses just described. It is obvious, therefore, that to approach the ideal, to eliminate line and cylinder losses and to get the maximum work possible out of a given weight of steam, sufficient heat must be added after it leaves the boiler, in order to counteract these tendencies to condense and to preserve its full energy for the development of useful horsepower.

The addition of heat to "dry saturated" steam raises its temperature in just the same way that the temperature of air is raised in a hot air furnace. The amount of superheat is designated by the difference between the actual steam temperature and the temperature that steam at the same pressure would have if it were dry saturated.

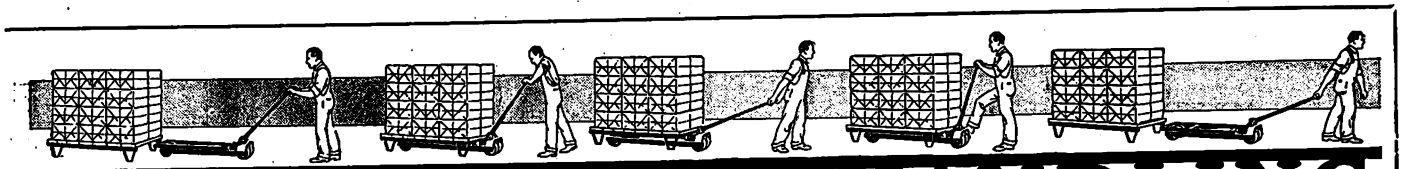
For example, the temperature of dry steam at atmospheric pressure is 212 deg. F. The temperature of such steam may be raised to say 312 deg. F. by merely heating it, although the pressure would still remain the same. It would then have 100 degrees of superheat.

It must be understood that steam cannot be superheated in the presence of water, since the added heat in the steam would immediately evaporate sufficient water to saturate it again. In doing this it would give up its surplus or "super" heat to the water which it evaporated and suffer a consequent reduction in temperature to where it was before.

In order to superheat steam and eliminate condensation losses, therefore, it is necessary to pass the generated steam through a heating device which is separate from the boiler proper. Such a device is a superheater. It consists of a series of tubes similar to the boiler tubes themselves, through which the steam from the boiler is passed. Usually the superheater is placed within the boiler setting, so that the gases of combustion, as they pass over the boiler tubes, heat the tubes of the superheater as well. In some cases superheaters are installed in a separate setting and are separately fired.

Although the possibilities and economies of superheated steam were known more than a century ago, the development of its use for power purposes was necessarily delayed, largely due to the fact that the attention of engineers was for the most part directed toward the perfection of prime movers, rather than the more economi-

(Continued on page 42)



ELIMINATE REHANDLING



Two Men
5 Minutes

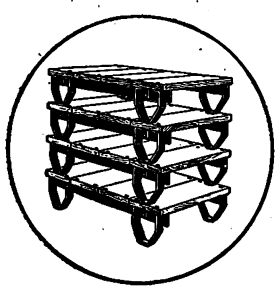


One Man
5 Seconds

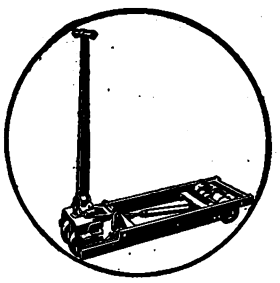
BY eliminating rehandling of goods and materials, as illustrated to the right, the Cowan Hand Lift Truck and Skid System is everywhere effecting large time and labor economies.

Goods and materials stored or placed on Cowan Skid Platforms instead of on the floor are quickly and easily picked up, moved, and unloaded, *without rehandling*. Run a Cowan Truck under a loaded skid, depress the handle with a single downward stroke—and skid with its load is elevated! Haul the loaded truck to destination, press the truck foot pedal—and skid with its load is lowered to the floor! All quickly and easily done by one man. No hand loading or unloading, piece by piece. No tie-up or delay of trucking equipment.

We have a special bulletin which will show you how the Cowan Lift Truck System, hand and electric, is effecting economies in *your particular* line of business. We'll gladly mail it on request.

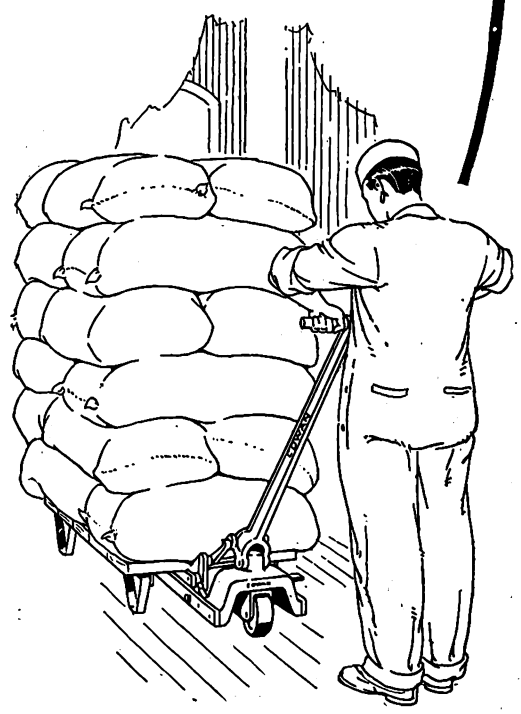


Cowan Skid Platforms—removable truck bodies for holding the loads.



The Cowan Hand Lift Truck—the chassis with elevating platform.

COWAN TRUCK COMPANY
6 Water Street, Holyoke, Mass.
Representatives in New York, Chicago, and other Principal Cities.
Largest Manufacturers of Complete Hand and Electric Industrial Truck Systems.



Down goes the handle
Up goes the load!

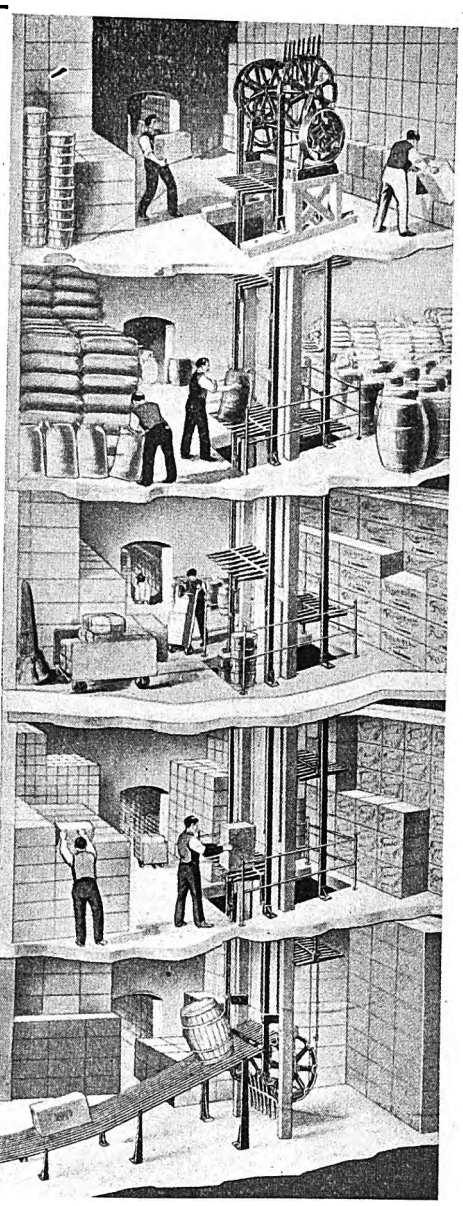
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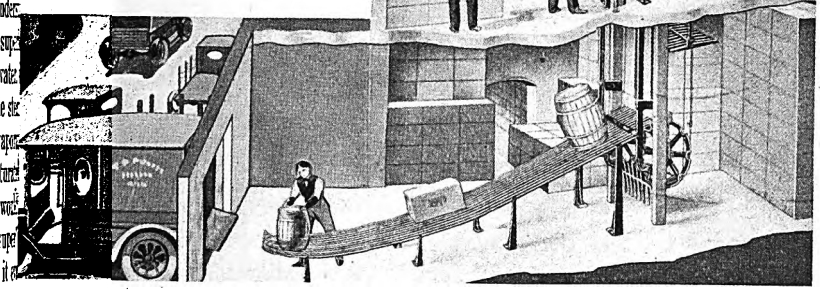


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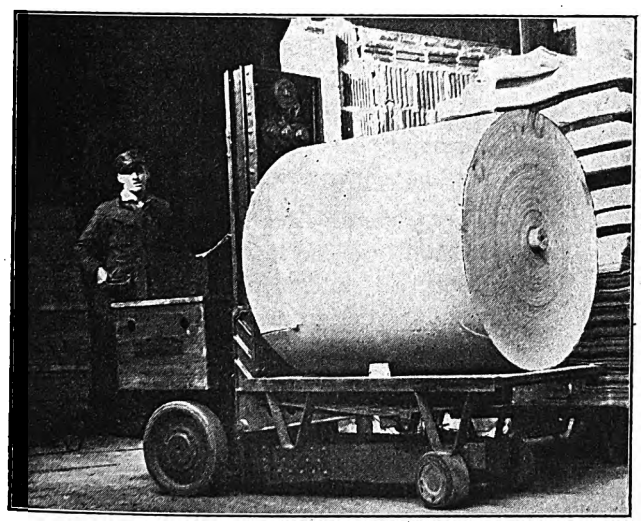
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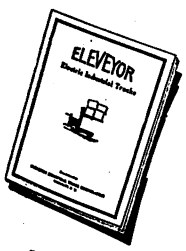
Lowerator Company, Inc.
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ELEVEYOR



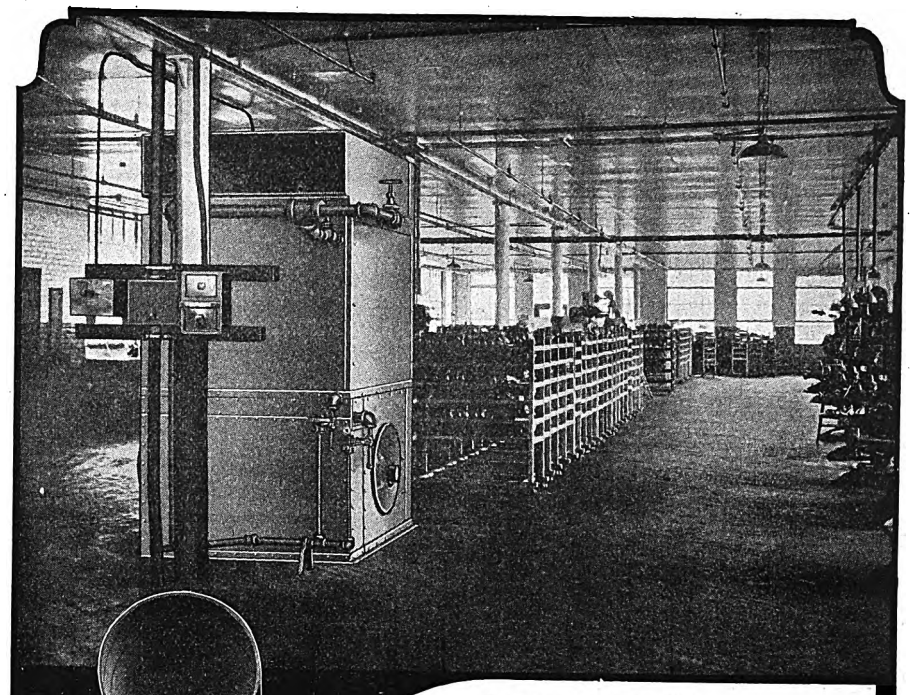
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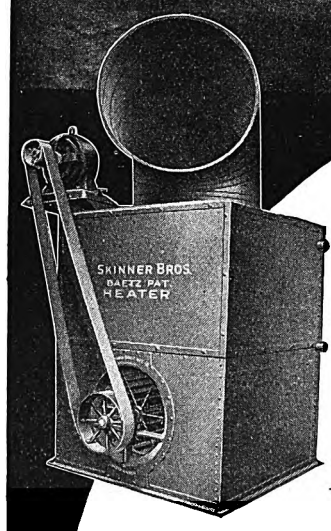
Send for the ELEVEYOR Catalog.

Here's another example of ELEVEYOR 3 in 1 performance—conveys product to and from box car, elevates and stacks. This user (name on request), saved the cost of the truck in three months. Formerly, 8 men were required to cart and stack—now, the driver and helper do all the work required, saving the wages of 6 men in the shipping department. Figure the savings, the ELEVEYOR can effect in your own plant!

ELEVEYOR INDUSTRIAL TRUCK CORP.
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Steam Coil Type SC
Utilizes live or exhaust steam at any pressure. Where steam is not available we supply our Direct-Fired Type DF. Burns coal, coke, wood, gas or oil.

Heat Your Plant This Better Way

HERE is a newer and better way to heat your plant. Skinner Bros. (Baetz Patent) Heater follows none of the principles of old time, unsatisfactory heating methods—it is revolutionary in design—the pioneer of its type.

Because of the simplicity and soundness of the Skinner Bros. (Baetz Patent) Heater design, it will heat every part of the open area of your building at all times—regardless of weather conditions, exposure or type of building construction. Satisfactory performance is guaranteed.

A Heater and Ventilator Combined

The Skinner Bros. (Baetz Patent) Heater can also be used as a ventilator—it is so arranged that fresh, pure air can be drawn through the heater, in practically any quantity desired and circulated throughout the plant.

No bulky system of outside pipes or ducts is used in the Skinner Bros. (Baetz Patent) Heater—the building interior can be kept free and open and the cost of pipes and ducts saved.

Send for Catalog D-9

Send for Catalog D-9—it fully explains the principle of this marvelous heater.

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A. Leschen & Sons Rope Co.
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Westinghouse Electric & Mfg. Co.
Lakehurst Naval Hangar
Ford Motor Co.
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Skinner Bros.
Baetz Patent HEATING SYSTEM

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(*Continued from page 40*)

cal use of the moving medium. It has been only in recent years that a more thorough and intelligent understanding of the principles involved has made possible the development of equipment for the generation and utilization of superheated steam for the development of power in an economical way.

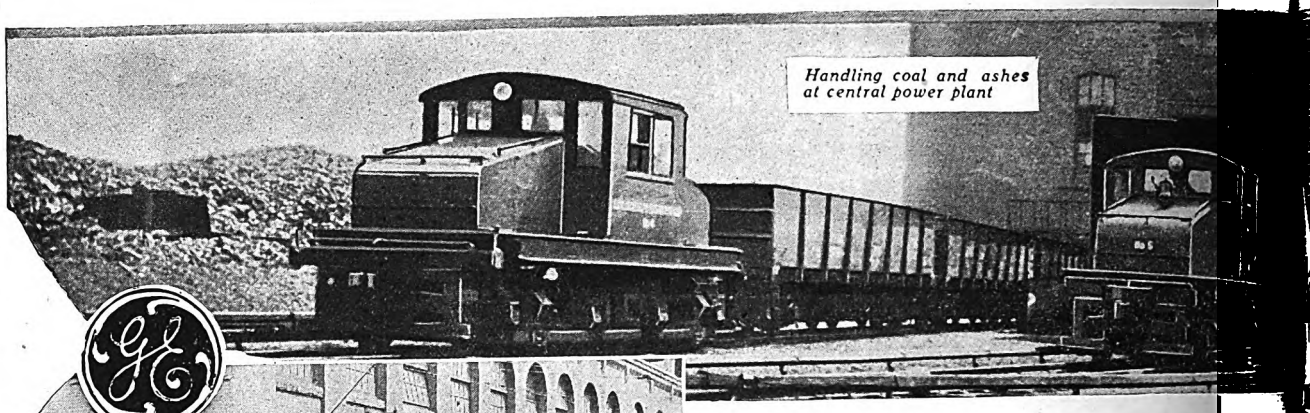
It is but natural that this development found its way first into the large central stations, where the cost of power was 100 per cent. of the cost of the finished product. The operating economies obtained were evidence of the practical value of the principles involved and offered an incentive for the gradual introduction of similar equipment into industrial power plants. Today the power plants of many industries throughout the country are equipped with superheaters and with engines or turbines specially designed for superheat.

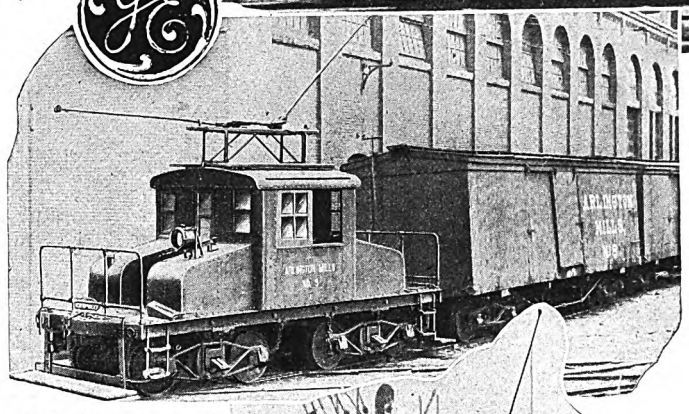
From the standpoint of efficient operation and economical power costs, the advantages of the superheated steam plant are manifold. Modern boiler design has made possible high operating efficiencies that were not possible years ago. The addition of a superheater unit to such an installation will naturally result in a greater coal consumption for any given quantity of steam evaporated and superheated. Actual tests, however, have shown that a greater amount of heat is absorbed and transmitted to the steam for a given weight of coal burned under a superheater installation than under an ordinary boiler. In other words, the over-all efficiency of a superheater plus boiler is slightly greater than that of a boiler alone, providing the superheater is properly designed and located. Obviously the addition of a superheater can have no effect upon the combustion efficiency in the furnace itself. It does, however lower the temperature of the gases leaving the boiler after they have passed over tubes and given their sensible heat to the water and the steam. This reduction in the temperature of the flue gases is an indication of a similar reduction in the amount of sensible heat lost up the stack. Just what this saving amounts to is difficult to determine by test, but the increase in efficiency is certain.

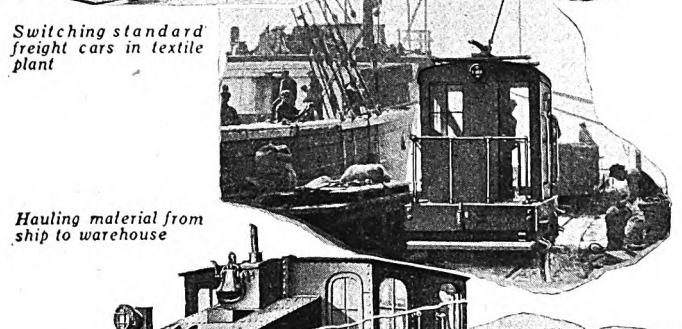
The installation of a superheater also has the effect of decreasing the load upon the boiler itself, since a smaller amount of superheated steam will do the same useful work than if the steam were dry saturated, the chief reason being that condensation losses are eliminated. The consequent reduction in load on the boiler may sometimes represent an appreciable saving in the wear and tear on the equipment. In some cases it may enable a smaller number of boilers to carry the same plant load.

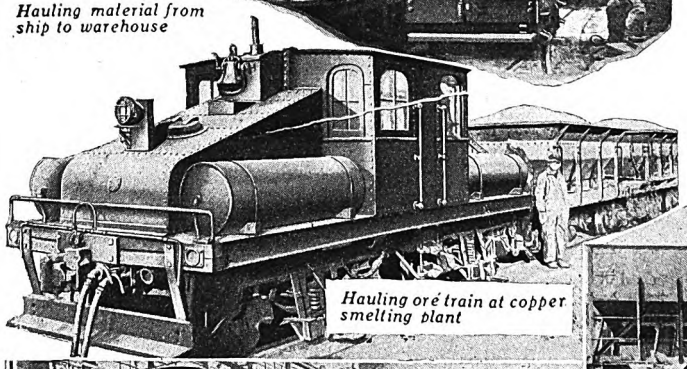
In the operation of every power plant there are certain losses commonly spoken of as line losses, consisting of heat lost for various causes in the steam lines leading from the boilers. The chief of these losses is that caused by the radiation of heat from the steam to the outer air through the pipe and insulation. Superheated steam gives up its heat less readily than does satu-

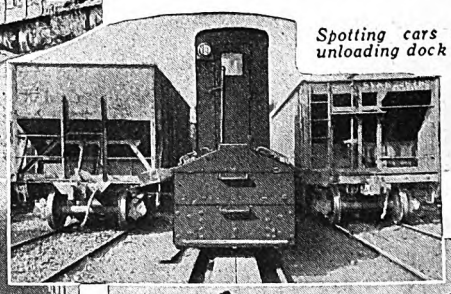
For Every Industrial Haulage Ne

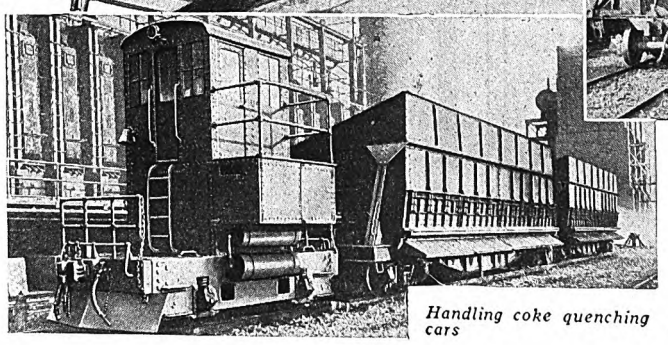


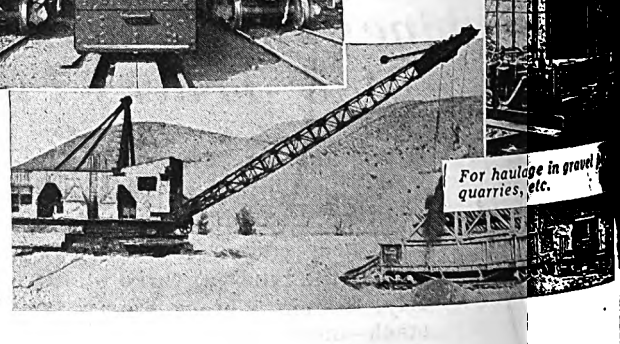












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When *you* buy haulage service—consider what o thirty years' experience in building complete ele tric locomotives can produce to exactly meet yo requirements. Back in the early nineties, the fir G-E Locomotive was put in operation. Every ye since has recorded increased use of G-E Electr Locomotives—keeping pace with industry's need for haulage equipment is the reason.

The General Electric Company builds complet locomotives—to insure well balanced design, bo electrically and mechanically. G-E Locomotives standard design are available for general industr

GENERAL

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rated steam and this loss is, therefore, minimized when superheated steam is used.

The radiation of heat from steam lines will cause a certain amount of condensation in the case of saturated steam, whereas superheated steam may lose a few degrees of temperature, but it will still remain steam and be available for expansive work when it reaches the engine or turbines. Line condensation for saturated steam is often in excess of 5 per cent. of the total steam carried.

So far we have considered only the minor losses involved in the distribution of steam from the boilers to the prime movers. In every case the losses with saturated steam have been greater than with steam at a suitable superheat. Added together they may often amount to quite an appreciable figure.

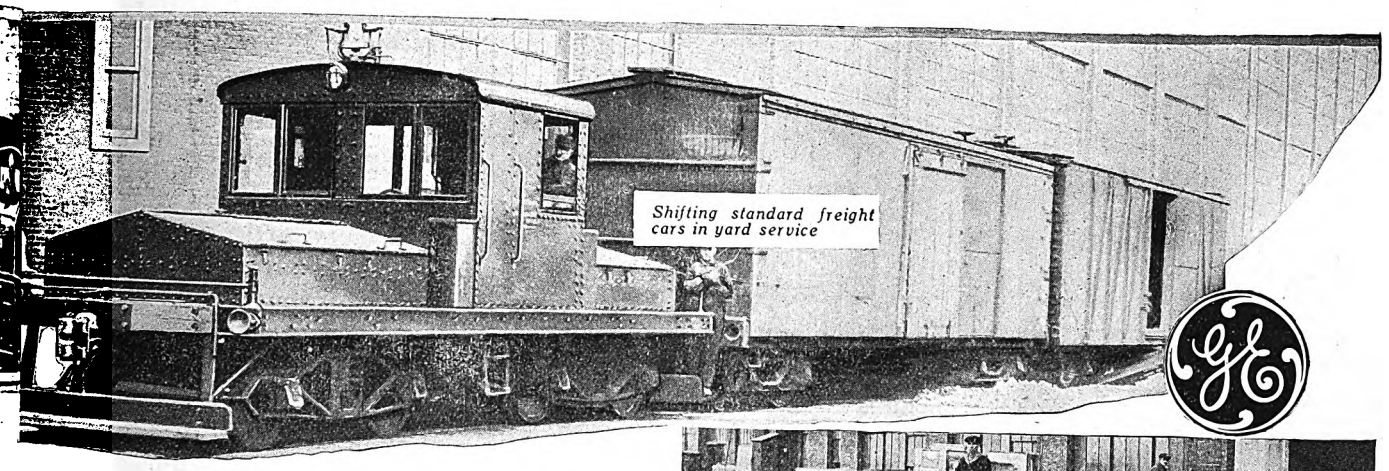
But the greatest and most important loss of heat, work and power in the use of saturated steam as compared with superheated steam is the condensation of the steam when it comes in contact with the cylinder walls of the reciprocating engine. This initial condensation is seldom less than 20 to 30 per cent. of the total weight of steam entering the cylinder, leaving only 70 to 80 per cent. of the steam available for useful work.

If the entering steam were superheated, on the other hand, the cooling effect of the cylinder walls would be sufficient to reduce the temperature of the steam to the saturation point before any condensation would take place. With 100 degrees superheat the temperature would have to be reduced 100 deg. F. Condensation will be eliminated if the steam is superheated sufficiently to permit of cooling without reaching the saturation temperature.

A single or twin cylinder simple engine offers the most severe condensation conditions to the entering steam. The steam expands from line pressure to atmospheric pressure on the forward stroke and is exhausted on the return. The cylinder walls are, therefore, cooled by low temperature steam just prior to the admission of high temperature steam for the next stroke. Compound engines, where steam is expanded in a high pressure cylinder down to an intermediate pressure and from there further expanded in a low pressure cylinder down to atmospheric pressure, offer a more moderate temperature range between the entering and leaving steam, and the condensation and counteracting superheat required is proportionately less than would be necessary for a simple engine.

Accurate figures on the savings possible through the use of superheated steam in reciprocating engines are difficult to obtain. Well-designed economical engines use a small quantity of steam to develop their rated horsepower. The amount of total cylinder condensation is proportionately low and the savings possible with the use of superheated steam are relatively small. Where the steam consumption is high, as in the case of uneconomical units, the possible economies increase proportionately. These savings may vary from 3 to 5 per cent. for 100 degrees of superheat in large economical plants using engines with a high ratio

ge here is a Suitable G-E Locomotive



orage Battery Uses

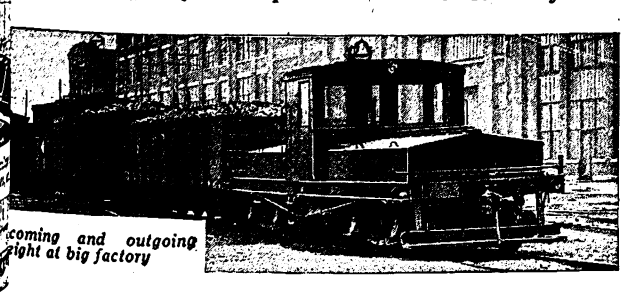
haulage conditions—and are easily adaptable to special requirements due to able engineering and ample production facilities.

Whatever you require for long heavy hauls—continuous peak load traffic—shifting at terminal—incoming and outgoing freight—short hauls between buildings, etc.,—there are suitable G-E Locomotives. You have but to submit the required duty and G-E engineers select the proper locomotive for the work.

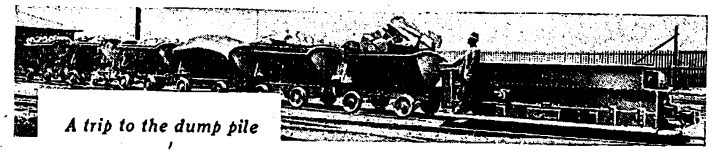
The G-E Locomotives shown here are of the Trolley, Third Rail, Storage Battery, and combination Trolley and Storage Battery types. More than views—they are evidence of the success with which G-E Locomotives meet, efficiently and economically, every industrial haulage need.

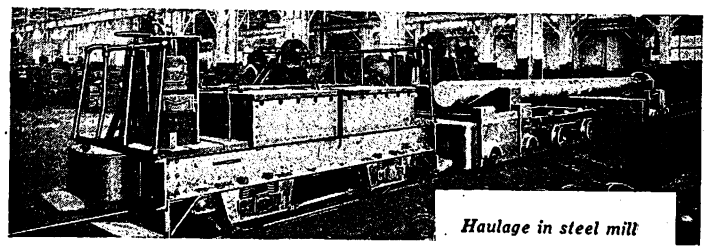
General Electric Company
Schenectady, N. Y.
Sales Offices in all Large Cities

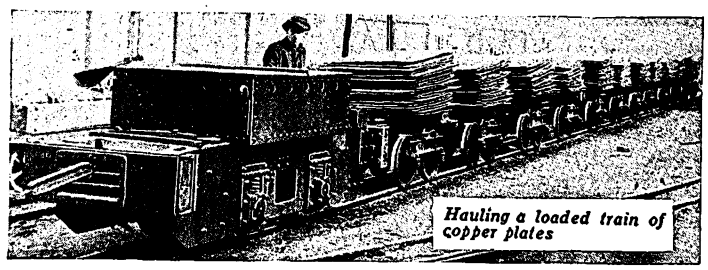
Interesting and valuable detail of the uses of electric locomotives for industrial haulage is contained in *Bulletin No. 44251* which will be mailed you free upon your request. Write for it today.

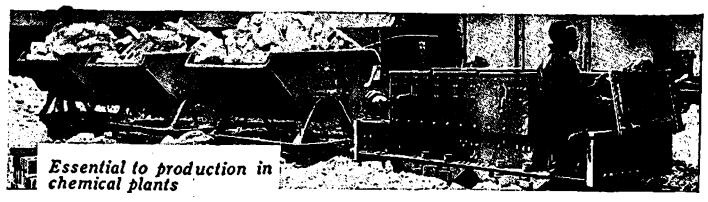

coming and outgoing ight at big factory


Haulage between buildings


A trip to the dump pile


Haulage in steel mill


Hauling a loaded train of copper plates


Essential to production in chemical plants


Used successfully in lumbering

ELECTRIC

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of expansion, to from 10 to 25 per cent. for 100 degrees superheat where less economical units are employed.

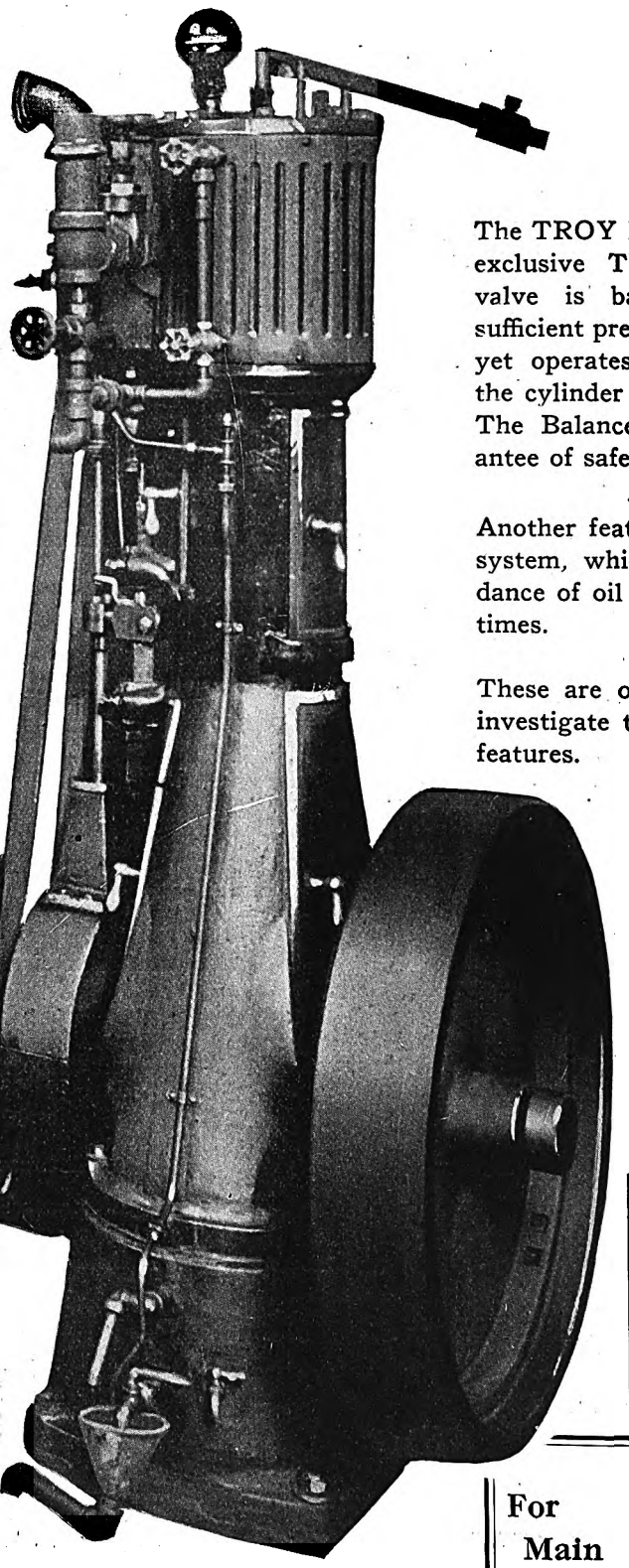
From the standpoint of operating economy the necessity of superheated steam is nowhere so vital as in the case of steam turbines. The rapid expansion of saturated steam as it passes through the blades of the various stages would produce sufficient condensation to cause serious trouble through the presence of water in the low pressure stages. Steam must necessarily be superheated for use in such types of turbines to avoid these difficulties.

The presence of moisture in steam passing through the turbine also has a detrimental effect upon the economy of the unit. Some authorities claim that a two per cent. loss will result for every one per cent. of moisture in the steam. It has been found that the water rate or steam consumption of a large economical steam turbine is reduced about one per cent. for every 12 degrees of superheat in the steam. This holds true approximately up to 200 degrees of superheat, at which the steam saving is approximately 16 per cent. On this basis, steam with 100 degrees superheat will effect a total coal saving of about 4 to 5 per cent. when operating an economical steam turbine, as compared to the operation of the same unit on saturated steam.

ONLY STEAM ENGINES GOOD ENGINES ONLY

TROY ENGINES

ONLY STEAM ENGINES GOOD ENGINES ONLY



A TROY ENGINE in your plant, is always a step ahead in economical plant operation.

Whether it is used for driving a stoker, for fans, blowers or other apparatus or in use direct connected to direct current generators, a **TROY ENGINE** means low cost in maintenance and dependable service always, under any and all conditions.

TROY ENGINES are standard equipment with a group of stoker manufacturers, due to the splendid results obtained in hundreds of installations.

Investigate the features of the **TROY ENGINE** and compare.

The TROY Balanced Valve is an exclusive TROY feature. This valve is balanced, except for sufficient pressure to hold its seat, yet operates freely and relieves the cylinder of any condensation. The Balanced Valve is a guarantee of safe operation.

Another feature is the self oiling system, which assures an abundance of oil to all bearings at all times.

These are only a few—why not investigate the many other Troy features.

Built in sizes 2 to 200 B.H.P.—Vertical, Horizontal and Direct-Connected.

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For Stoker Operation

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For Main Power Purposes

Troy Engine & Machine Co.,
TROY, PA.

DEPENDABLE POWER with ABSOLUTE SAFETY

When writing advertisers please mention Industry Illustrated

"The industrial accident problem in America, which is now causing approximately 20,000 deaths and 500,000 injuries annually, will never be fully controlled until the public accident problem is controlled." C. W. Price, Vice President of the Elliott Service Company, New York City told the members of the American Society of Safety Engineers.

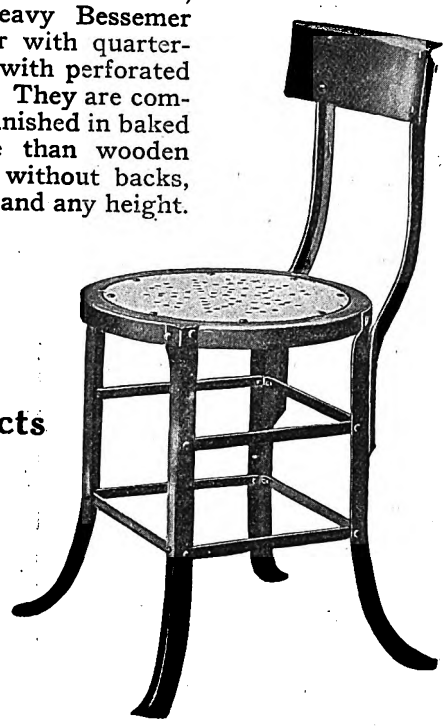
Some of the biggest industrial concerns in the country including the United States Steel Corporation, Mr. Price said have already come to this conclusion and are now actually giving the workmen in their plants instruction in the prevention of accidents on the street, in the home, and in other public places. Industrial executives, he said, are beginning to realize that it is easier to get workmen seriously interested in accident prevention at home and on the streets than in the plant because in the former case the lives of their wives and children are concerned and the average workman even of the lowest type is usually more interested in the safety of his family than in his own life.

"The question that we must consider, therefore, is whether safety can be organized in a community as it has successfully been organized in the great industries with a continuous campaign of education which will grip men, women, and children alike and cause them to stop being careless and cause them to be careful. Until very recently we could not truthfully say that such a thing was possible. My experiences convince me that it is now possible for any community to organize the work of accident prevention on as scientific and as effective a basis as it is organized in the modern industrial plant, railroad, or public utility."

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The Everlasting Chair

That is what our all-metal chairs really are. They have pressed steel seats and backs, formed angle iron legs, heavy Bessemer rungs, and are put together with quarter-inch rivets. Also furnished with perforated wood seats as shown below. They are comfortable for the user, neatly finished in baked enamel, and cost no more than wooden chairs. Furnished with or without backs, 3 or 4 legs, 12 or 14-in. seats, and any height.



METAL MEECO PRODUCTS

Other Meeco Products Include

SANITARY WASH BOWLS
METAL LOCKERS
DRINKING FOUNTAINS
STEEL SHELVING
WORK BENCHES
STEEL PARTITIONS
BOXES AND CABINETS

Manufacturing Equipment & Engineering Co.

Factory and General Offices

Framingham Mass.

PREFERENCE

Whatever preference a manufacturer may have for

Tycos
Temperature Instruments

is due to two facts

QUALITY and SERVICE

Tycos
TEMPERATURE INSTRUMENTS
INDICATING • RECORDING • CONTROLLING

are built for Steam Power Plants, Sugar Makers, Refrigerating and Cold Storage Plants, Canning, Milk Industry, Varnish and Asphalt Making, Oil Refining, Steel Treating, Baking, Tire Making and all other industries that use temperature in processes.

What do you make? Information on any application and catalogs sent.

Taylor Instrument Companies

Rochester, N. Y., U. S. A.

Canadian Plant, *Tycos* Bldg., 110 Church St., Toronto.

THERE'S A *Tycos* OR *Taylor* TEMPERATURE INSTRUMENT FOR EVERY PURPOSE.

Where Minutes Are Vital

(*Continued from page 20*)

"change of climate."

One other feature which does not show in the accompanying illustrations is the ceiling in the composing room. A single linotype machine operating in an ordinary room makes about as much noise as a typewriter. When you put a battery of fifty linotypes at work, there is what might be called considerable din.

In the *Tribune* composing room, the customary noise is conspicuous by its absence—a tribute to the unostentatious work of acoustic engineers. They have made a ceiling of perforated metal, superimposed upon felt; a combination which absorbs sound instead of reflecting it, and which looks, on casual inspection, for all the world like a ceiling made up of panels of dotted Swiss.

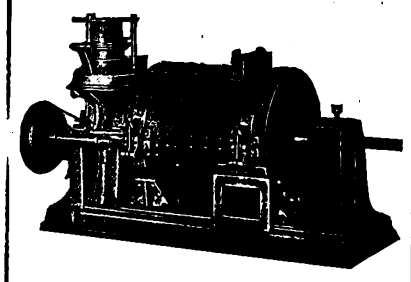
We have described these particular features at length, because neither of them is susceptible of explanation by illustration. To attempt to go into such detail regarding each and every feature would require a great deal more space than we have available. The accompanying illustrations with their captions, however, will probably serve much better than any extended word-portrayal to give a bird's-eye view of this most up-to-date newspaper plant.

The new *Tribune* building is, as a matter of fact, not merely a wonderful project; it stands as proof of the soundness of the principles on which modern production methods and modern management science are founded. The haphazard method has gone, the so-called "efficiency expert" has had his brief day; but true scientific management has proved that it is not confined to any one industry or to any single kind of industry, but to all industry.

Seen in a perspective of five years since the Armistice, there is much to justify the belief that European conditions are actually making definite progress towards normal. In many countries the economic situation is obviously better than it was a year ago.

(The Guaranty Survey)

Pulverized Coal



The Aero Unit System

of Pulverized Coal again demonstrates, as in other work of huma endeavor, how an original idea at first worked out by complicated and costly methods is finally simplified and perfected until it becomes a part of our every day existence.

The Unit System reduces the equipment and therefore the cost to a minimum by placing the Aero Pulverizer at the furnace where the coal is fed to the machine undried and is exhausted therefrom directly into the furnace. There are no dryers, no storage or long lines of transportation for the powdered coal, thus eliminating the hazard of fire or explosion.

Each Aero Pulverizer is designed as a complete powdered fuel unit for one furnace. They are built in standard sizes ranging from 600 lbs. to 5000 lbs. of coal per hour.

Bulletin Sent on Request

AERO PULVERIZER COMPANY

165 Broadway New York

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670,000 Horsepower of Electric Heat

(*Continued from page 23*)

This furnace can be operated at higher temperature than the carbon resistor type, and, at the same time can be regulated to operate at lower temperatures economically but with the additional feature of automatic control.

The electric furnace, in actual use has reached the temperature of 3,500·C. Recent experiments in the Research Laboratory of the General Electric Company, have, however, developed a furnace which gives a temperature of 4,500 C. enough to volatilize diamonds. A comparison of these temperatures with that of the sun, which is estimated at 5,000 C gives a striking idea of what can be accomplished in handling refractory substances with electric heat.

There are other types of electric furnaces, which, although simple in construction, are capable of doing in one operation things which formerly took several heatings. In making shells, for example, for large calibre guns, it is necessary to expose different sections of the same shell to different degrees of heat. With an electric furnace this is done by simply combining heating units of varying resistance, according to the degree of heat desired, in the same furnace.

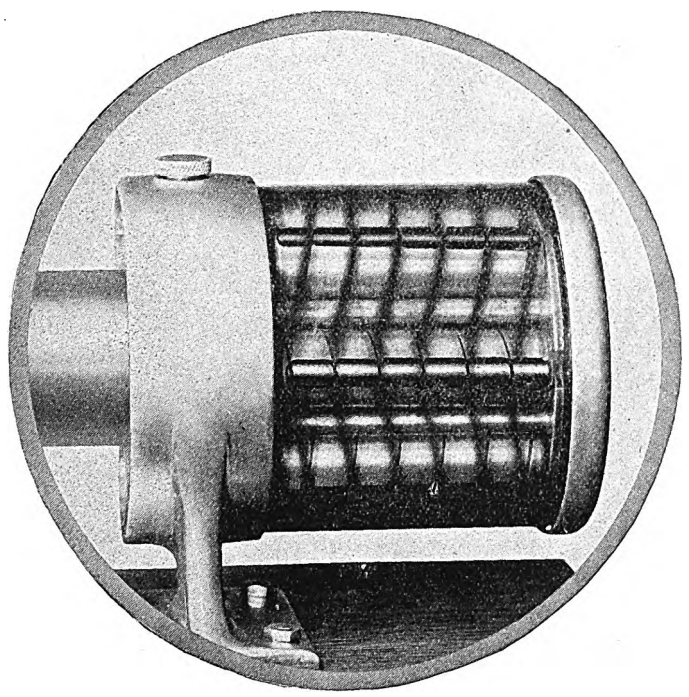
The war was responsible for many new devices designed with a view to increasing production quickly. One of the things the government needed most was ships—lots of them, and in building ships an enormous amount of rivets have to be heated, and that quickly. The usual methods of heating these rivets was in a forge, usually burning coke or oil as fuel, which, after a careful survey, was found to be woefully inefficient. The attendance was large, requiring a blower man as well as a passer, large quantities of rivets were burned, welded together, or insufficiently heated in the forge, and when it had to be taken into the hold of the ship for use, the difficulties of operation were only exceeded by the vileness of the atmosphere resulting from the fumes of the forge.

The result was the electric rivet heater. Rivets are now heated by inserting them between two heavy copper bars carrying a heavy current, supplied by a transformer. Since the iron of the rivets themselves is a material of high resistance, they are heated thoroughly and quickly. The bars are operated by a foot pedal, so that when the rivets are removed, or being placed in position to be heated. The current ceases to flow. The whole apparatus is easily portable.

It was found that this simple machine heated the rivets throughout, that inasmuch as the energy was used only when the rivets were actually being heated, there was no waste of heat, there were no noxious fumes, or spoiled and wasted rivets, and that the machine was nearly as fool-proof as it could be. The attendance was reduced to a minimum, and there was no necessity of sup-

(*Continued on page 49*)

Did You Ever See a Hyatt Roller Bearing *In a Glass House?*



Here is a Hyatt roller bearing mounted in glass instead of steel to enable you to observe the circulation of the oil.

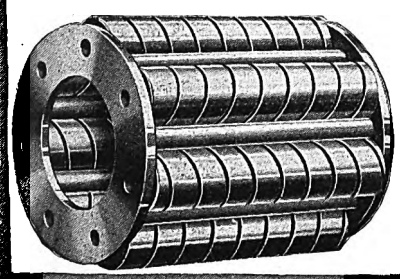
As the hollow rollers revolve, the oil flows out of the slots in parallel bands which cover the entire bearing surfaces. As long as any oil remains in the bearing it will be constantly picked up by the rollers and distributed in the path of the following rollers.

Because of this positive, self-oiling feature of Hyatt roller bearings it is only necessary to add lubricant to them occasionally, usually 3 or 4 times a year, which makes a worthwhile reduction in lubrication costs, oil and labor.

This positive, self-oiling feature of Hyatt roller bearings is only one of their good points.

Their true rolling motion saves power and manual effort in worthwhile amounts and their durable high grade steel construction enables them to effect these economies throughout the life of a machine without adjustment or replacement.

Specify Hyatt roller bearings for your cranes, trolleys, hoists, conveyors, for industrial trucks and trailers, machine tools, lineshafts and every kind of machinery where economy and dependability of operation are desired.



Hyatt Roller Bearing Company

Newark Detroit Chicago San Francisco

Worcester Milwaukee Huntington Minneapolis Philadelphia

Cleveland Pittsburgh Buffalo Indianapolis

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More Handled with Fewer Hands

A Correction

In our advertisement appearing in the August issue of Industry Illustrated, referring to Jeffrey equipment in the plant of The American Sugar Refining Company, it was stated that "the aluminum conveyor buckets described ..... were designed and installed by The Jeffrey Manufacturing Company."

While the equipment referred to is our well known Pivoted Bucket Carrier, we feel that the credit for its adaptation in design and installation to the particular needs of this plant of The American Sugar Refining Company should go to Richard Morton, Engineering Contractor of Baltimore, Maryland, through whose office it was handled.

(Signed)

The JEFFREY MANUFACTURING CO.

THE acute labor shortage existing today makes it imperative for every manufacturer employing one or more men for handling material to take immediate steps to cut down mounting labor costs.

Add men, and you add excessive labor costs. Add machinery and you multiply the effectiveness of the men you now have.

An installation of Jeffrey Labor Saving Machinery solves the labor problem permanently—it increases production—it makes bigger profits possible.

Wide experience over a half century has resulted in the development of a complete line of Jeffrey standardized conveying and material handling machinery.

Jeffrey Engineers will gladly help you in working out plans you may have for more efficient handling of material or in suggesting new economies in the manufacture of your product.

The Jeffrey Mfg. Co. 946-99 North Fourth St., Columbus, Ohio

New York, 2008 Hudson Terminal Bldg.	Chicago, 858 McCormick Bldg.	Pittsburgh, Rea Bldg., 622 Second Ave.	Philadelphia, 515 Real Estate Trust Bldg.	Montreal, Canada, Power Bldg.

Cleveland, Ohio.....1519 Guardian Bldg.	Detroit, Mich.....455 Book Bldg.	Los Angeles, Cal.....H. W. Hellman Bldg.
Denver, Colo.....1751 Wazee Street	Milwaukee, Wis.....M. & M. Bldg.	Charleston, W. Va.....914 Kanawha Street
St. Louis, Mo.....606 Pontiac Bldg.	Boston, Mass.....141 Milk Street	Scranton, Pa....518 Union Nat'l Bank Bldg.

JEFFREY

MATERIAL HANDLING *AND* MINING EQUIPMENT

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He has taken the place of the "stokers" of yesterday

ENGINEERING and mechanics have triumphed over the slipshod firing methods of yesterday—and hundreds of plants are harvesting great savings in coal and labor costs.

In place of the gangs of sweating human stokers is an engineer who smoothly directs the operation of mechanical stokers which respond automatically to the varying demands for steam.

In place of the old conception that an inferno of fire in a boiler furnace means heat, is the modern knowledge of just what each atom of coal is accomplishing—a knowledge based on the intensive study and research of the combustion engineers who have developed mechanical stoking.

In place of the old time struggle to "meet the peak loads" is the quickly responding mechanical stoker that will make a boiler produce steam many times in excess of its rated capacity.

All this stoker firing has accomplished for industry—all this it will accomplish for you if your plant is still hand fired or is not fired by a scientifically applied mechanical stoker.

The exceptional possibilities of stoker firing are covered by an interesting book, "Coal—the basic fuel." Read it.



Stoker Manufacturers Association
G. A. SACCHI, Secretary
Lester Branch, Philadelphia

Uhl Steel Tool Trays and Stools for Factory Use



The Uhl Steel Factory Equipment line contains many styles and types of stools and tool trays, offering selections for practically every factory requirement. For nearly a quarter of a century they have been a favorite with institutions who demand utmost durability and economy in equipment and their users include many of America's greatest corporations.

UHL Steel Stools

Uhl Steel Stools solve the seating problem once and for all. Every detail of their construction reflects quality materials and skilled workmanship. No stools on the market are more durable or comfortable. They eliminate up-keep cost and outwear any other stools made. Our service records disclose countless instances where Uhl Stools are still rendering satisfactory service and still retain their sturdiness and shape after fifteen years of hard usage.



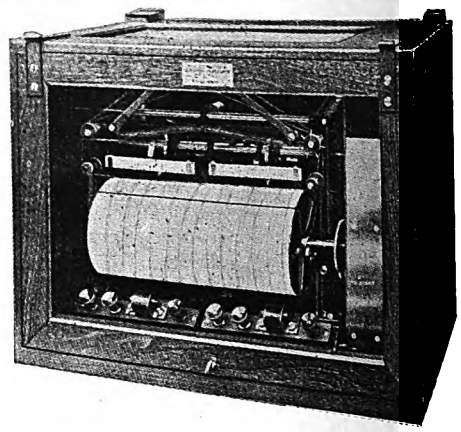
UHL Steel Tool Trays

Uhl Steel Tool Trays fullfil hundreds of needs in industry. In the tool room, garages, lathe room, foundries, machine shop—wherever there are tools and equipment to be moved about, Uhl Tool Trays save hours of valuable time each day, in addition to providing a convenient, safe place for storage when tools and other equipment are not in use. Uhl Trays are indestructible, each one being made to withstand the hardest usage. All cold-rolled steel—nothing to break. No upkeep expense. Easily handled. Quotations and other details gladly furnished.

The Toledo Metal Furniture Co.
1620 Hastings Street Toledo, Ohio

Manufacture s of
Uhl Steel Furniture, Typewriter Desks, Chairs, Tables, Stands, Vault Trucks and Factory Equipment

Co_2 Readings from 4 Boilers on the One Chart



Helps Solve an Important Boiler Room Problem

A 4-Point CO_2 Recorder—one of the types of Cambridge Recorders, made to show the comparative efficiencies of four boilers.

CAMBRIDGE ELECTRICAL CO_2 RECORDERS INDICATORS

Save time by having a continuous record of boiler performance right in front of the operator.
They are entirely electrical—no chemicals to renew—no glass or rubber parts to break or wear out. Can be installed any distance from the flue. As accurate as an Orsat with none of its faults or maintenance troubles.
Other Cambridge instruments—Electrical Distance Thermometers. Thermo-electric Pyrometers, Optical Pyrometers, Draft Gauges.
Send for List 157 X.

The Cambridge and Paul INSTRUMENT Co. of AMERICA (INC.)
MAIN OFFICE AND FACTORY OSSINING-ON-HUDSON NEW YORK | INCORPORATING CHAS. F. HINDLE | SALES OFFICE & SHOWROOM GRAND CENTRAL TERMINAL NEW YORK CITY

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(*Continued from page 46*)

plying fuel, with the consequent trouble in disposing of the ashes when it was being operated in more or less inaccessible parts of a ship. It has a capacity of 800 ¼″ rivets 1″ long per hour, which is enough under ordinary conditions for a gang of gun riveters.

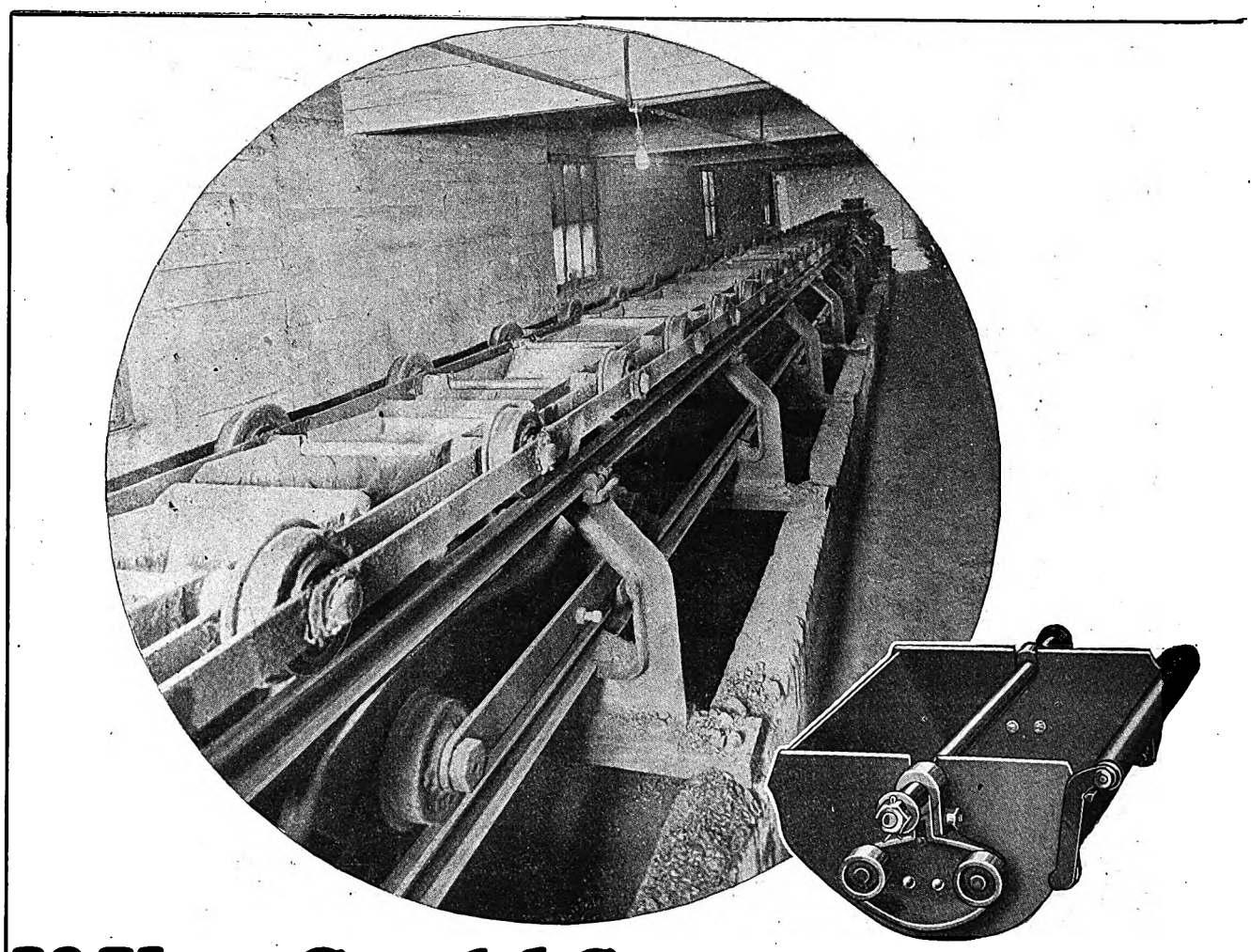
The place where electric heat has found its greatest application, from the standpoint of number of installations at least, is in electrically heated ovens or air drying and baking apparatus, as one prefers. It is surprising how many products that are necessities of our every day life require an oven treatment somewhere in the course of their manufacture.

Electric ovens are used more in the automobile industry than in any other field. Here 100,000 kw. are used in baking the japan on 3,000 automobile bodies every day. In a few years, the automobile whose japanned parts are not baked in an electric oven will be a rarity. Other large users of electric ovens are foundries, for baking cores, telephone and typewriter manufacturers, manufacturers of iron cots and bed frames and chemical manufacturers of various sorts.

Oven processes include baking, air tempering, drying and sherardising. Of these four the first is the most used, the other two are quite common and the last is a process for protecting exposed iron parts from corrosion.

In many of these processes, accurate regulation of heat, and automatic control are absolutely necessary, because many materials are irrevocably ruined by a slight change in the temperature of the oven. And here again, manufacturers have found that the saving in material which was spoiled by the vagaries of the fuel heated furnace, has more than paid for the increased expense of installing and operating a bank of electric ovens.

Of these three classes of ovens, those installed for baking are the most numerous. The work they do varies; baking japan on various articles, baking enamels, cores and colored inks on lithographic plates. The japan baking oven has been developed from the experimental stage in the past four years. The process of baking japan in fuel burning ovens, owing to the fact that volatile and explosive liquids such as naptha and kerosene are used as solvents, has always been a somewhat hazardous operation. The gases given off are of a highly explosive nature and more frequently these ovens have exploded with decidedly disastrous results. Another fault of this fuel oven was, that in baking the lighter colors of a japan, or enamels, soot from the gas sometimes would discolor the baking articles. Some of the ovens used in this work are of the conveyor type, so that loads can be loaded and unloaded while one is baking. The capacity of two of these ovens used in one plant is greater than that of six gas heated ovens formerly used to do the same work. It takes about three-quarters of an hour to complete a baking, in one factory where these ovens are largely used which more than doubled the number of loads finished per day, with a saving of 70 cents per load,



If You Could See

THE Perkins Pivoted Bucket Carrier At Work—discharging a continuous stream of coal on the upper run and ashes on the lower run of conveyor—at a tremendous saving of man power—

YOU would clearly understand the great preference for this ideal, economical conveyor. Your first impression will be quickly confirmed when you see how perfectly this bucket carrier works in the boiler room.

The Perkins Pivoted Bucket Carrier handles both coal and ashes with low operating and maintenance charges. It does the work mechanically releasing labor help for more profitable work.

Sturdily built and mechanically correct in design it insures years of reliable and dependable service. This is demonstrated by the number of Webster installations successfully operating in power plants today.

Our trained staff of engineers is at your service and will furnish particulars of this improved bucket carrier upon word from you.

THE WEBSTER MFG. COMPANY

4500-4560 Cortland Street, CHICAGO

Branch Offices

BOSTON.....902 Oliver Bldg.
BUFFALO.....572 Ellicott Square
CINCINNATI.....1914 Union Central Bldg.
CLEVELAND.....509 Swetland Bldg.
NEW YORK.....90 West Street
PHILADELPHIA..719 Commercial Trust Bldg.

Factories

CHICAGO, ILLINOIS TIFFIN, OHIO

Agencies and Representatives

Atlanta, Ga.....Fulton Supply Co., 70 Nelson St.
Baltimore, Md..H. W. Faunt LeRoy, 523 Calvert Bldg.
Birmingham, Ala...G. R. Mueller, Brown-Marx Bldg.
Denver, Colo.....C. L. Dean, 1718 California Ave.
Detroit, Mich.,Palmer-Bee Co.,2778-2794 E. Grand Blvd.
Knoxville, Tenn...Webster & Co., Holston Bank Bldg.
Louisville, Ky...E. D. Morton & Co., 516 W. Main St.
Memphis, Tenn..E. C. Atkins & Co., Maine & Butler Sts.
Milwaukee, Wis....W. Clasmann Co., 620 Wells Bldg.
New Orleans, La., Globe Supply & Machinery Company, 625-627 S. Peters Street.
Pittsburgh, Pa...Dempcy-Degener Co., 708 Penn Ave.
Salt Lake City, Utah, L. W. Mendenhall, 517 McIntyre Building.
Salt Lake City, Utah.....Gallgher Machinery Co.
Seattle, Wash., The Brinkley Company, 651 Alaska St.
Vancouver, B. C...B. C. Equipment Company, Ltd., 613 Bank of Nova Scotia Bldg.

Canadian Factory-Sales Office: WEBSTER-INGLIS, LIMITED, 14 Strachan Ave., Toronto, Ont.

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which ran up into thousands of dollars when figured on a daily basis. The quality of work turned out is superior to that of the old type, it requires little or no attendance and the fire hazard is largely eliminated.

In speaking of japan it is interesting to know that a new type of japan is being developed which consists of an emulsion of the asphalt base with water, thus removing the fire hazard besides being much cleaner to handle. This process is called water japan.

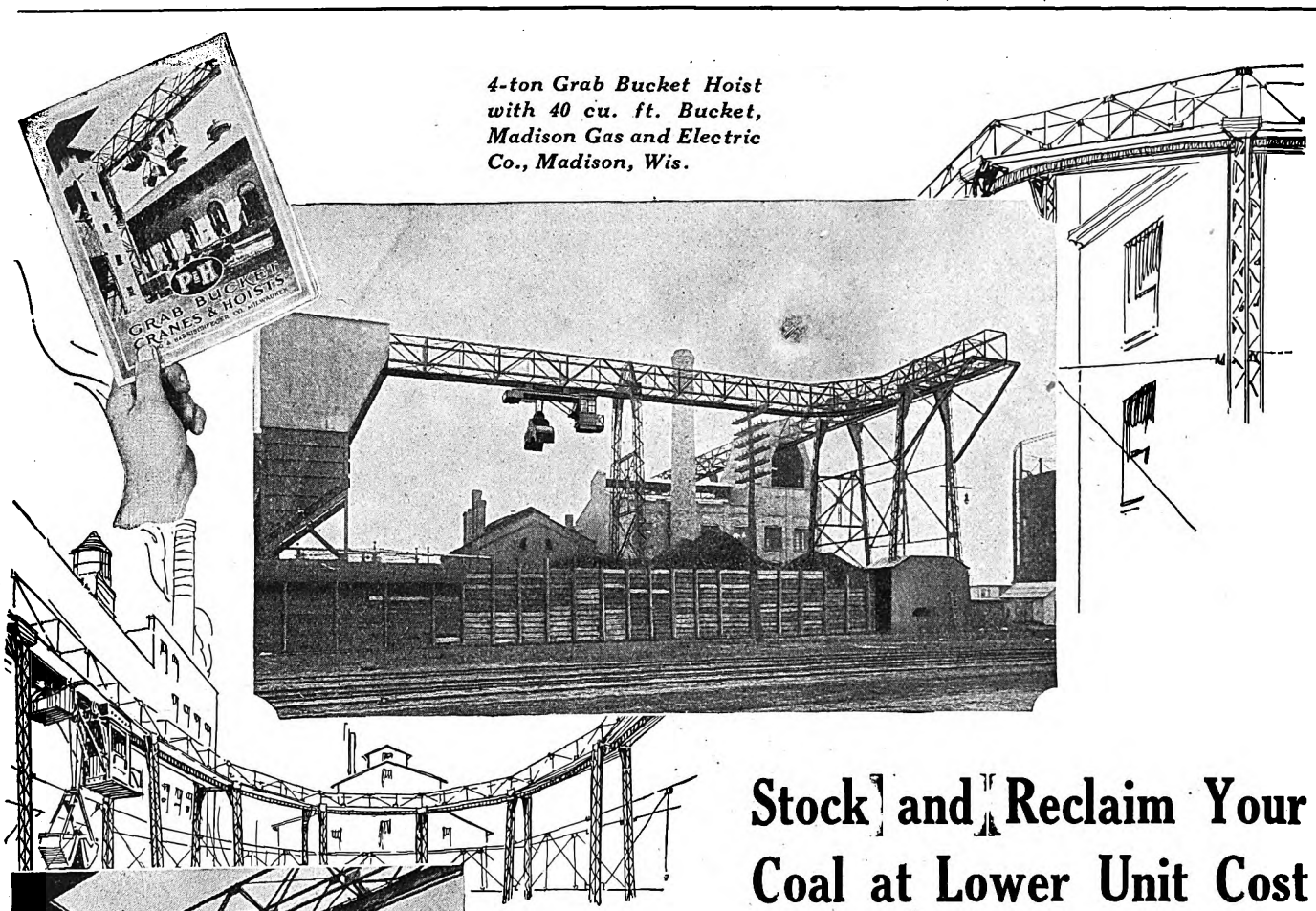
Ovens are used for many other purposes; sterilizing dental instruments, baking effervescent salts, and drying all sorts of products requiring well regulated heat and a clean atmosphere in the oven itself. The fact that their temperatures can be so exactly regulated, and absence of a mass of fuel carrying pipes, fumes, soot, and other by-products of burning gases, make the electric oven ideal for this purpose.

The fourth process mentioned, electric sherardizing is a patented process for protecting exposed iron parts from corrosion due to exposure to the weather. Briefly, it consists of baking these articles, together with zinc dust in a revolving oven. They are given a coating of zinc that has proven superior in resisting corrosion to any form of galvanization, or other protection heretofore used. Even pin holes and sharp corners, screw threads and other accessible places are evenly and thoroughly coated by the process.

Besides ovens, furnaces, and the other devices mentioned there are a number of small "individual" electrically heated pots, furnaces, etc., for use in the shop, garage or even at home. In this class are compound melting pots, flue pots, metal melters, small furnaces and electric soldering irons.

Many of them are easily portable, in fact can be attached to almost any lighting or shop circuit. For work in a book bindery or pattern shop for instance, the electrically heated pot keeps the glue continuously at just the right temperature for use, but never burns it; the same may be said of the compound melting pot and the lead or babbit melter, which are ideal for work and around a garage or in a factory. As for the soldering iron, any one who has used the gas heated type on top of a ladder, or in some accessible place need not be told the advantages of an iron that is always hot and still light and well balanced enough to be used with accuracy and comfort to the operator.

In spite of its growth in the last few years, the application of electrical heating to industry is only in its infancy. The time will undoubtedly come when the effort to conserve our natural coal and gas resources will cause it to assume much larger proportions. There is generally no limit to its possibilities of development not only as applies to factories, but in offices and homes. The saving of floor space, cleaner and more healthful working conditions, to say nothing of the improved speed of production and superior quality of work done, all tend to make its universal adoption but a matter of a comparatively short time.



4-ton Grab Bucket Hoist with 40 cu. ft. Bucket, Madison Gas and Electric Co., Madison, Wis.

Stock and Reclaim Your Coal at Lower Unit Cost

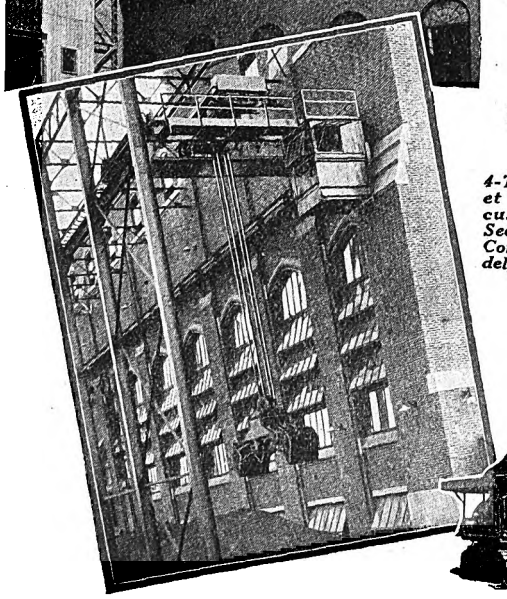
P & H Grab Bucket Cranes and Hoists because of the low cost of operation,—economy of ground space, high speeds, (large motors are built into frames) and their mechanical efficiency, meet the demands for low unit handling costs.



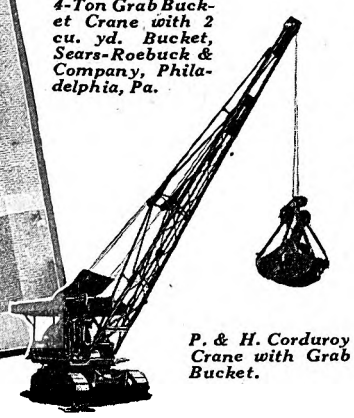
P & H 3-ton Grab Bucket Hoist, Milwaukee Gas Light Co., Milwaukee, Wis.

High stock piles are possible—and, particularly with the Grab Bucket Hoists because of being able to build the runways around curves,—all available ground space can be reached.

There are but few moving parts, and a minimum amount of electric power is required—because of friction losses being lower than on conveyor systems.



4-Ton Grab Bucket Crane with 2 cu. yd. Bucket, Sears-Roebuck & Company, Philadelphia, Pa.



P. & H. Corduroy Crane with Grab Bucket.

The Experience Gained in Building Over 7,000 Cranes and Hoists is Yours

No matter what material handling problem you have, the chances are a thousand to one that P & H engineers have had experience along those lines which will help in making recommendations. While coal handling is all-important today, such materials as coke, ashes, sand, gravel, slag, mill-scale, cement clinker, ores, concentrates, chemicals, sugar, etc., are equally well handled with P & H Cranes and Hoists.

Ask for new Bulletin 305.

Crane and Hoist Division

PAWLING & HARNISCHFEGER

Established in 1884

3850 National Ave., Milwaukee, Wis.

Offices and Agents in Principal Cities

P&H CRANES and HOISTS

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Training the Inexperienced Worker

(*Continued from page 13*)

worn out plan of "absorption."

Then the war came and our young men were leaving the industries like "rats from a sinking ship" because of the opportunity offered to serve their country, and it became necessary to quickly induct inexperienced hands into our plants and shops and train them for single purpose operations in order to rapidly produce war necessities. Then the call came to all who had gained experience and knowledge along the line of Vocational Training; directors and instructors were sought far and wide, and through the efforts of the Council of National Defense, these men were placed in all our large industries to develop and install "Training Departments" or as the English would say, Vestibule Schools.

Industrial training gave the manufacturers of America such a wonderful service during the war that immediately after the signing of the Armistice the wise employers decided to continue the "Schools" and those who were unable to secure training directors during the war were the early bidders for the available leaders of this important work who had been released by "War-Baby" concerns that had to close their doors.

The Winchester Repeating Arms Company did some training during the war and was successful in any attempted, and as early as was prudent after the reconstruction period the management immediately considered the policy of testing training, upgrading and adjusting all new or inefficient employees who were entering the plant or already employed there.

It might be well to explain what is meant by a "Vestibule School" in an industry. The English idea was that in order to properly induct "green hands" into their plants and introduce them to the processes peculiar to the individual industries, it was necessary to have a building or room in or near the plant where these new-comers could first be taught the shop customs and spirit, safety rules, checking-in and -out methods, shop decorum, getting acquainted with shop environments, overcoming nervousness as well as being instructed and trained on the machine or bench previous to being sent into the plant proper on production work.

Thus it will be seen that the term "vestibule" is intended to convey the thought of a vestibule to a theater, trolley car, etc., where the persons entering have time to adjust themselves, get their tickets, remove their outer clothing and become prepared to enter, calm and collect, ready to continue unruffled and with a clear mind and understanding of what they are to do.

At The Winchester Repeating Arms Company "The Central Training Section" was used to receive and train the larger part of the new help em-



Casting a Big Shadow

A NEW Mercury tractor is coming. It's already throwing a big shadow over the industrial tractor field.

A need has long existed for a machine of this kind that would attain a standard of work-output efficiency impossible in the best models now in use. The Mercury organization has met this need. A new era in industrial transportation is thereby ushered in.

You will want to know all about this revolutionary development, and how it makes possible 25% more work from the same expenditure of energy. We'll be glad to tell you or send our new Type H bulletin on request.

Mercury Manufacturing Company

4119 S. Halsted Street — Chicago, Illinois

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ployed, (See Fig. 1) for the Training Department controlled more than a "school room," as the nature of the training activities at the Winchester Repeating Arms Company's plant covers "Segregated Sections" (Fig. 2) as well, and as these are controlled by the Training Organization it was necessary to make the scope of training broader.

The Segregated Sections of training are fenced off rooms which are installed in the plant departments when it is imprudent to move the equipment and work to the centralized section. In all such cases the room is usually partitioned off with standard shop partition and an instructor selected who is capable of properly training in the cunning handwork of the work he is teaching.

The reason why these sections are sometimes segregated is because the peculiar nature of the work to be trained on requires the learners to be near to the atmosphere of the work to be learned or the equipment is too heavy to be moved to the central training section. However, it is not always best that the learners be near to the old hands while in training.

All instructions are given on actual production work, (See Fig. 3) which gives the trainees the proper impressions and causes them to perform with care, under actual shop conditions, the operation to which they are assigned, so that upon promotion from training to the plant proper the trainee finds no difference in the methods of handling the job trained on or in the equipment used in producing the work.

One of the main reasons why a Training Department is of importance to a large industry is that in event new-comers try one operation and do not succeed, or show a dissatisfaction for the job, they can be quickly transferred to other jobs in the Training Department until misunderstandings and difficulties are smoothed out and the man properly placed, thus cutting down the abnormal turnover experienced by manufacturers in most plants at the present time.

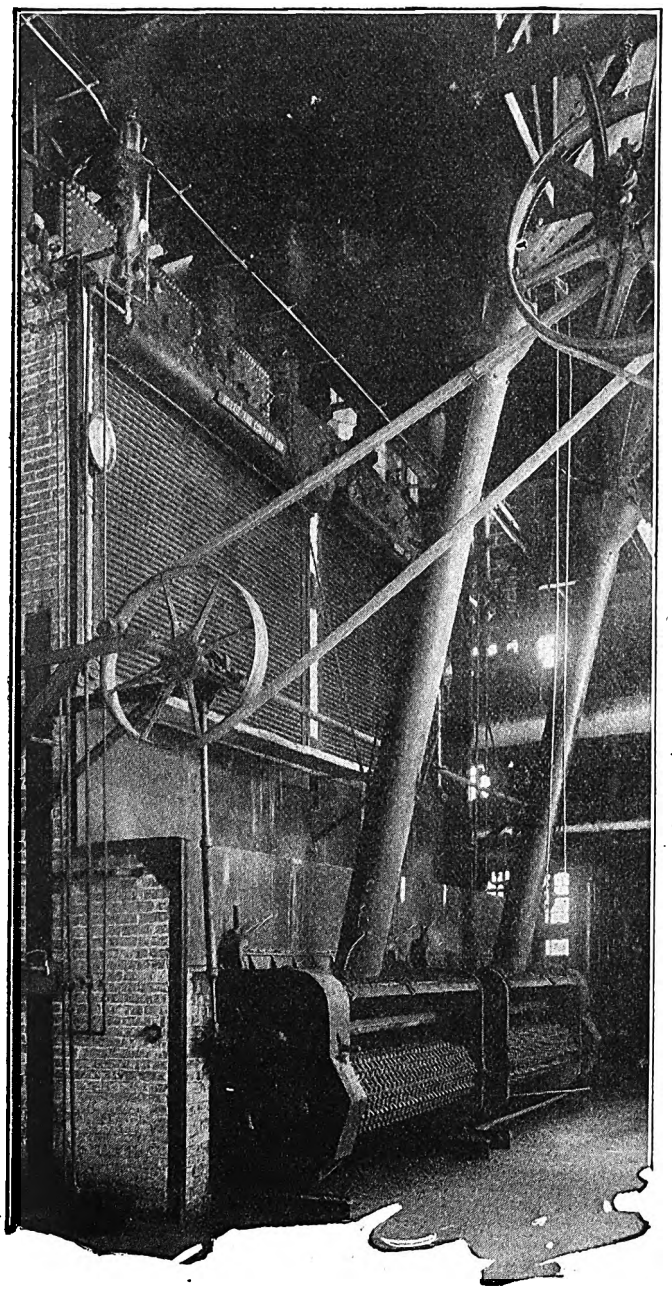
The "Intentional" Training Method eliminates waste because all beginners are properly "shown how" and watched until proficient before they are allowed to try their hand and then are carefully shown again in event of a mistake or misunderstanding. In case the help in training is not absorbed by the plant departments, due to sudden changes of schedule or reduction of inventories, they are kept in the Training Department turning out the same production work as the shop, with the additional advantage of being on hand when needed in an emergency.

There is also this advantage when a Training Department is in operation: If perchance the plant department foremen discover inefficient employees, they may be sent to the Training Section covering the operation they are working on, and, when "upgraded" they can be returned to the shop as better operators and more satisfied workmen.

The W. R. A. Training Department developed some 90 sections of training for operatives, following a

(Continued on page 54)

MORRIS





THE name of Morris has for 65 years been outstanding as a pioneer in the packing industry throughout the world. Wherever civilization has reached, Morris Supreme Products are well and favorably known.

For its power plants on two continents, Morris & Company has chosen Edge Moor Water Tube Boilers. In the past sixteen years, 33 Edge Moor Boilers of 13,618 aggregate horsepower have been placed in service in all Morris plants from Illinois to Argentine as essential factors in the production of a yearly output of many hundred million pounds of foods.

These 33 boilers represent fifteen separate orders—strong evidence of the proved value and economy of Edge Moor design and construction.

The Edge Moor catalogue explains why these boilers have won preference in a score of leading industries. Your request will bring a copy promptly.

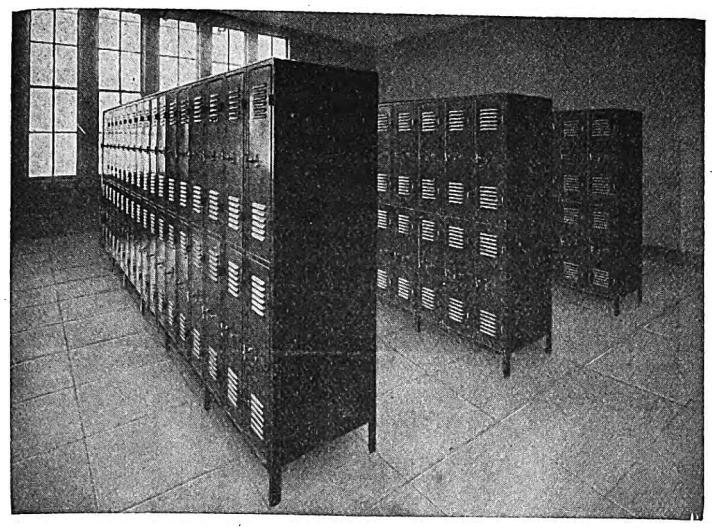
EDGE MOOR IRON COMPANY
Established 1868
EDGE MOOR, DELAWARE
New York Chicago St. Paul Boston Pittsburgh Charlotte

Two 498 H. P. Edge Moor Boilers in the Chicago plant of Morris & Co.

EDGE MOOR
Water Tube BOILERS
FOR INCREASED FUEL ECONOMY

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EMPLOYEE GOOD WILL MEANS LOWER COSTS

Wise employers of labor know that without the good will of their organization, nothing worthwhile can be accomplished in the way of cost reduction.

Providing safe, private storage for employees' clothes and personal belongings is an important step toward this ideal condition.

An installation of Berloy Lockers is tangible evidence of a real consideration for the workers' comfort.

Catalog Y-50 gives complete information.

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THE BERGER MANUFACTURING CO., CANTON, O.

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(B) BERLOY

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15 Acres of Floor Space
100,000 Parts Daily

Our Estimates Will Show A Big Saving For You

To lower production costs is an ever-pressing, every-day problem. There are many manufacturers who have solved this problem at a big saving in time and money by discarding heavy, cumbersome castings and forgings and, in their place, using lighter, better and more uniform pressed metal parts.

We have specialized for more than 42 years in this work. Our plant has 15 acres of floor space and is equipped throughout with the most modern machinery.

G.P.&F. SERVICE
"KNOWING HOW SINCE '81"

G. P. & F. Service means that we can make for you high grade pressed metal parts in steel, brass, aluminum, copper, tin plate, or sheet zinc, and deliver them when and where they are wanted, at a lower cost than if you manufactured the parts in your own plant.

No matter how difficult or intricate your designs may be we guarantee to execute them to your complete satisfaction and make the parts to your order in any desired quantity.

We also are equipped for Gas and Electric Welding, Tinning, Galvanizing, Japanning and Porcelain Enameling.

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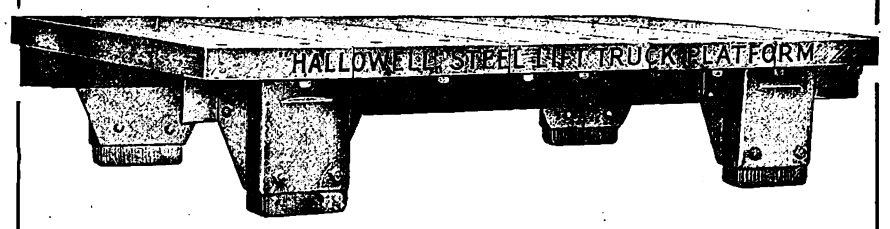
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HALLOWELL

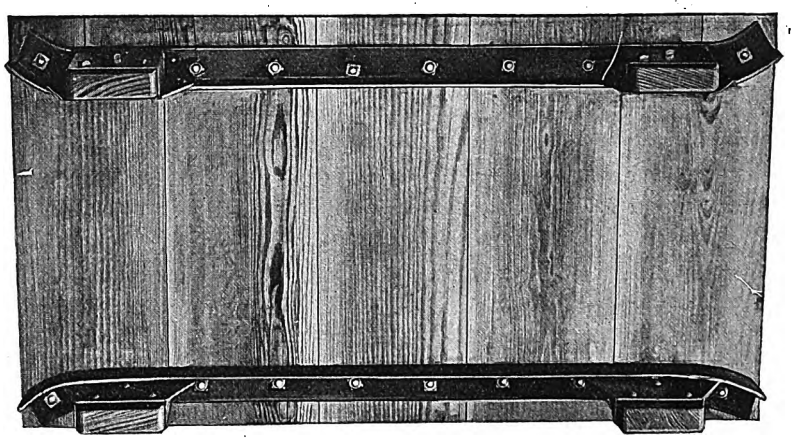
STEEL LIFT TRUCK PLATFORMS



The "Hallowell" Runners are constructed of heavy angle steel to which are attached steel leg holders of a special and substantial design. These parts are joined by large rivets, hydraulically driven, a method which prevents any possibility of their working loose.

This detail of construction is of vast importance as unless the legs are rigidly and permanently attached to the runners they will gradually become wobbly and unreliable.

The "Hallowell" joints remain tight—they cannot do otherwise.



Ends of runners are flared, as shown by above illustration, an exclusive "Hallowell" feature, which greatly simplifies entering the truck.

The value of this feature is soon realized by the workman after platform is put into service.

STANDARD PRESSED STEEL CO., JENKINTOWN, PA.

(The "Pioneer" Steel Hanger People)

INVESTIGATE

STANDARD PRESSED STEEL COMPANY, JENKINTOWN, PA.
Gentlemen: Kindly send me full details and prices of "Hallowell" Steel Reinforced Platforms.

Name.....

Company.....

Address.....

Truck used.....

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Two Kinds of Count—Two Kinds of Result

Count the product while the machine operator *works*—and the count shows *real work!*

Count it after the operator finishes his day, and it figures about what it would without counting at all.

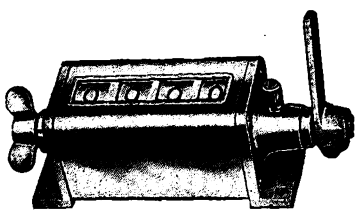
The record made when the *effort* is made, is what keeps the worker intent on doing his best. It's kept before him *automatically* by a

Veeder
COUNTER

The small Revolution Counter below registers one for a revolution of a shaft, recording a machine operation, or product. Though small, this counter is very durable; its mechanism will stand a very high rate of speed, making it especially suitable for light, fast-running machines, and most adaptable to experimental work. If run backward the counter subtracts. Price $2.00. (*Cut 3/5 size.*) Small Rotary Ratchet Counter, to register reciprocating movements of small machines, also $2.00.

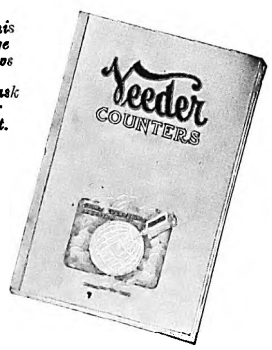


The Revolution Set-Back Counter below records the output of any machine where a shaft-revolution indicates an operation.



Sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price, with four figure-wheels, as illustrated, $10.00—subject to discount. *Cut less than one-half size.* Set-Back Rotary Ratchet Counter, to record reciprocating movements as on punch presses, $11.50 (list).

FREE—This new 80-page booklet shows everything you could ask in a counter ASK for it.



The Veeder Mfg. Co.
63 Sargeant St., Hartford, Conn.

(*Continued from page 52*)

the operations: Gun Polishers, Screw Polishers, Milling Adjusters, Drop Forgers, Knife Polishers, Knife Assemblers, Knife Sharpeners, Press Operators, Bench Assemblers, Scissor Bow Strappers, Electrical Helpers, Sheet Metal Helpers, Buffers, Wrench Polishers, Knife Hafters, Knife Glazers, Scissor Grinders, Scissor Assemblers, Bench Filers, Gun Machine Adjusters, Utility Service Men, Bamboo Rod Winders, Plier & Wrench Millers Machine Adjusters, Die Sinkers, Blanking Die Makers, Trimming Die Makers, Lathe Operators, Mill Machine Operators, Drill Press Operators, Sharper Operators, Planer Operators, Grinder Operators, Shop Clerks, Office Clerks, Fish Reel Assemblers, Battery Core Winders, etc.

Any man or woman who desires to learn a trade or occupation can do so by aplying to the Employment Department and asking about the opportunities this great plant has to offer, and again any man or woman already employed by the W. R. A. Co. can give advancement by applying to the personnel representative assigned by the company to canvass the shop departments.

A great many men who had worked in the gun division as common operators applied for an opportunity to *train* and develop as Gun Machine Adjusters which fits them, after learning to become foremen and later superintendents providing they have the right qualifications and ambition.

The equipment in the Training Department is typically the same as that used in the plant proper, (See Fig. 4) although in some cases improvements are made in order to facilitate a more rapid handling of the work. But when these improvements are discovered, the plant rapidly adopts the same and the equipment soon becomes universally used.

The length of time for learning varies according to the operation, but in all cases the training is intensive and a beginner is taught all the "short cuts" to aid rapid production before being promoted into the plant.

The method of training is governed by the operation to

(*Continued on page 56*)

Don't Say It! Write It!

A good plan to avoid error and shifted responsibility. A slogan which has helped production everywhere

but---

having written it—how is it delivered? Do you depend on costly and slow messengers who may lose it? or delay it? or forget it? Telautograph equipment, costing less than boys, will *deliver* messages as *rapidly as they are written* to one or fifty points simultaneously, and in the exact handwriting of the sender, in indelible ink! We can prove you need Telautographs—let us try now.

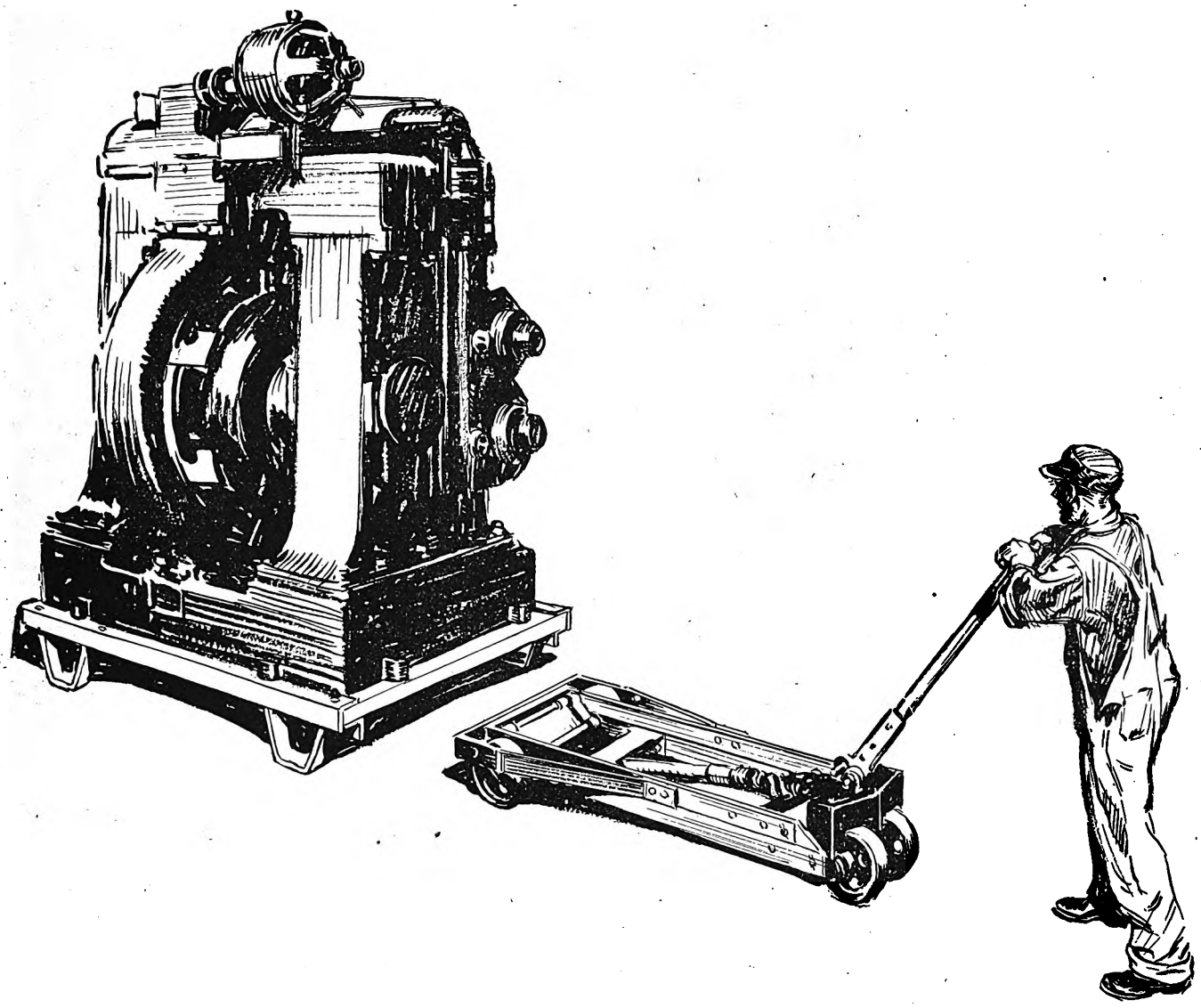
No Obligation!

We have 31 Service Stations in United States. We are now rendering service in 108 cities in the United States.

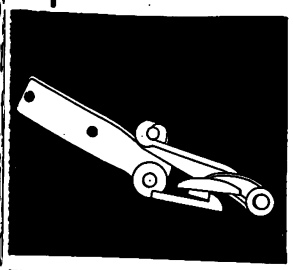
Telautograph Corporation

448 West 37th Street, New York.

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There's no re-handling of materials when a Stuebing hauls the load



This independent lock, like every other part of a Stuebing, is given only one job to do. Designed with an unusually broad locking surface and built to hold loads tons heavier than truck capacity. No part of a Stuebing can be overworked—the secret of life-long wear and low upkeep.

Here's a surprising fact: The money that is spent for unnecessary handling of materials, when hauled by ordinary four-wheel trucks, will buy Stuebing equipment *that will entirely eliminate re-handlings.*

And not only that. Stuebing Lift Trucks also enable *one* trucker to do the work of *five* men with ordinary trucks—an 80% saving of labor.

These figures we quote, however, are based wholly on the use of *Stuebings*, which are different from any other lift truck made. The upkeep cost on a Stuebing is practically *nil.*

Here's an example: The upkeep cost on 98 Stuebings owned by the Firestone Tire & Rubber Co. of Akron, Ohio, has averaged less than 1/2c per day, per truck, over 4 years.

Now it stands to reason that your whole purpose in replacing your present hauling system with lift trucks is to save money.

So be sure that these savings are *permanent*, protected by low upkeep costs on your equipment.

The heads of the country's greatest industries will tell you that they chose Stuebings because their phenomenally low upkeep cost is not even approached by any other lift truck made.

No other lift truck is built like a Stuebing!

Write today for our complete 36-page catalog—a handbook on economies in material handling.

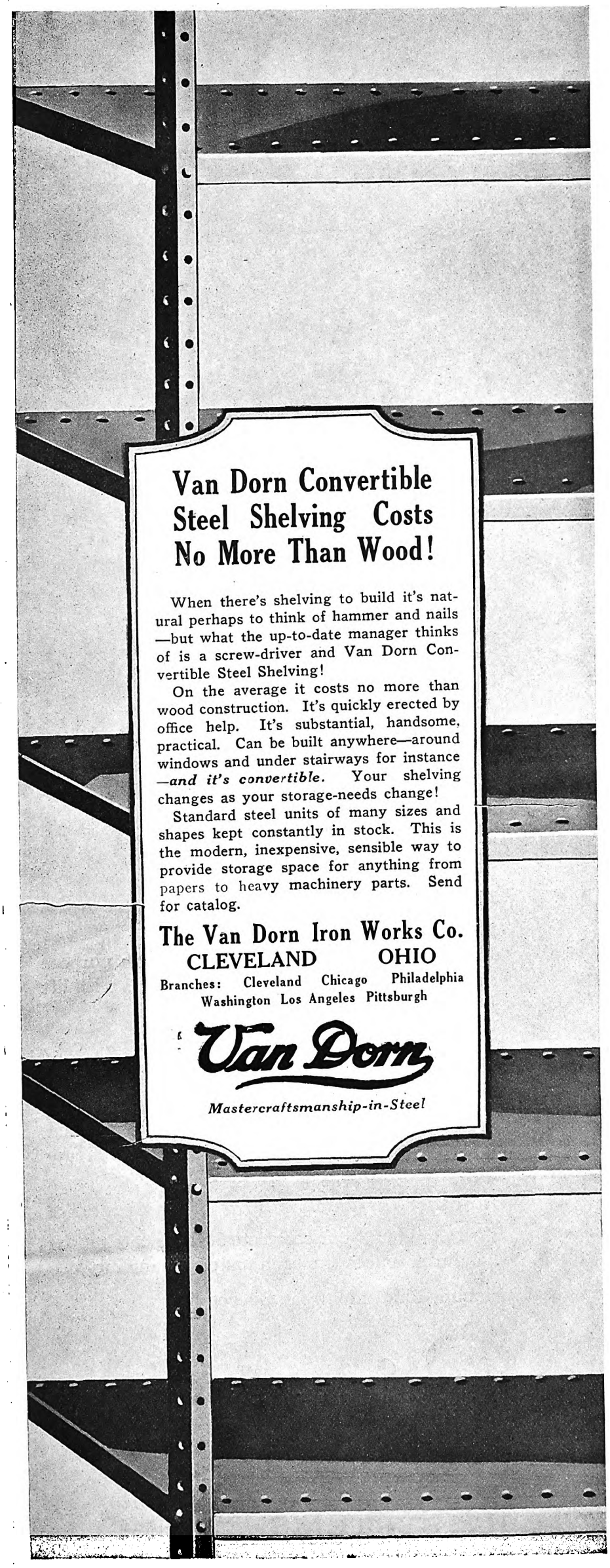
The Stuebing Truck Company, Cincinnati, Ohio; Montreal, Quebec

StueBing

LIFT TRUCK SYSTEMS

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(Continued from page 54)

be taught, but instructions are all carefully laid out on paper as a guide for the instructor to follow and are always clear and carefully presented. These instruction papers are prepared for the instructor as well as the trainee. These sheets cover all the important practical, theoretical and auxiliary knowledge pertaining to the trade, occupation or operation. The instructor does not necessarily follow these instructions in the order laid down, but proceeds with the practical work, being governed by the instruction sheets which he refers to from time to time to ascertain whether the training is being fully covered.

As a check on the instructor a set of question papers are prepared for each trainee to answer, and in event some question is asked which has not been covered by the practical instruction, the trainee is compelled to challenge the instructor regarding same, which brings to light the fact that some given point has not been explained. This gives the instructor an opportunity to cover the subject part at once, and thus fulfill the instruction aimed at.

The results achieved by this method have been very successful. Men trained as Sheet Metal Workers, Electrical Wiremen, Drop Forgers, Milling Machine Adjusters, etc., advanced very rapidly under this type of instruction. The men so trained went into the plant, enlightened and active in the work trained on, while the foremen and superintendents were greatly relieved of the training responsibilities by receiving men trained, as well as instructed in the W. R. A. methods and shop spirit.

An instructor must first be an expert workman, fully understanding all the cunning handicraft of his trade, or any separate operation of that trade. In addition to this handicraft knowledge, the instructor must develop the ability to impart to those whom they intend to teach, the knowledge they have acquired through practice. In other words, an instructor must be a master of the art which he is expounding.

The greatest care should be exercised when "picking" an instructor. Men selected from the regular shop field are preferred to those selected from outside sources, provided they are well directed. Plant executives will not recommend a man to act as an instructor of other men who will be used later as operatives in his shop, unless that instructor is one who has proven himself worthy and well qualified to carry on the operation he is to teach.

Every operation or process has certain "kinks" and "tricks" which are acquired by workers and absorbed by new persons entering the activity, and it is only through training that these points can be covered rapidly and without encountering the hazards liable to face men or women who are thrown into a plant and left to absorb what they can without a definite plan of instruction.

Then again, an instructor selected from the plant will usually perform the same while instructing others as he has done previously as a workman, and although he now has an opportunity for a larger personal expression and development, at the same time his ambition will always be to please the plant departments which he is serving through the Training Department.

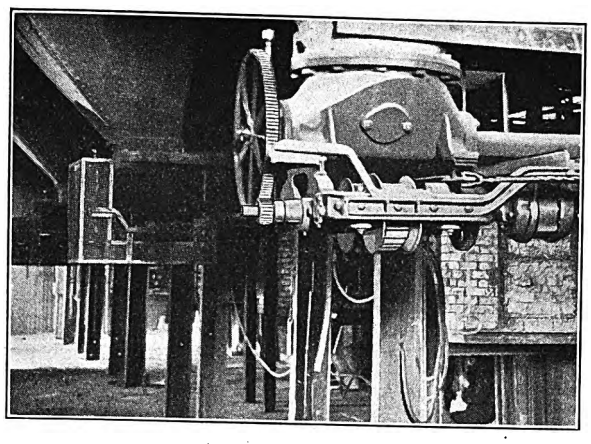
The environment of the Training Department is such that it invites suggestions from its instructors and many new ideas come to the surface which have been lying dormant for a long time.

A workman selected as an instructor has to be open minded and broad gauged if he intends to make good.

The most successful instructors are those who are agreeable to suggestion and willing to impart the knowledge pertaining to their trade, and have no secrets up their sleeves, who are above reproach and clean, upright men and women. Instruction data is furnished them and they use it as a guide when teaching. It is not always possible to supply such data at first when an operation for training is opened, as the first move necessary is to get the practical equipment started, but all operations no matter how simple should be covered by instructional guides and question papers before the trainee can be prop-

(Continued on page 58)

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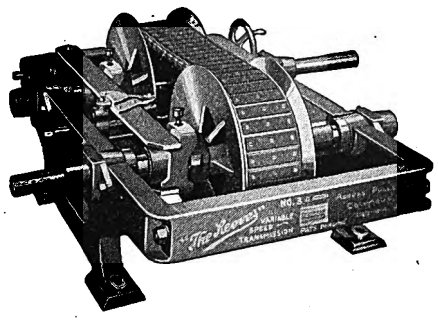
Courtesy of Raymond Bros. Engineering Co., Chicago. Installations of 8 No. O-D Reeves Transmission, Illinois Malleable Iron Co.

"The Reeves"

VARIABLE SPEED TRANSMISSION

INFINITE SPEED VARIATION
Easily and quickly obtained

Simple to operate. Inexpensive to maintain. Reduces cost to such an extent that it pays for itself in a very short time.



"THE REEVES" Variable Speed Transmission, as now manufactured, represents the most perfect mechanism procurable for the purpose of transmitting VARIABLE SPEEDS.

Its appeal to users is based solely on its ability to not only save money but to increase production and improve the quality of his goods.

The eight annealing ovens shown above cut, formerly required a man at each furnace, as well as a complement of coal passers to maintain the proper heat. Since the adoption of "The Reeves" Transmissions on the new pulverize coal system, one tender and his assistant now operate the entire battery.

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AIR For Every Industrial Purpose

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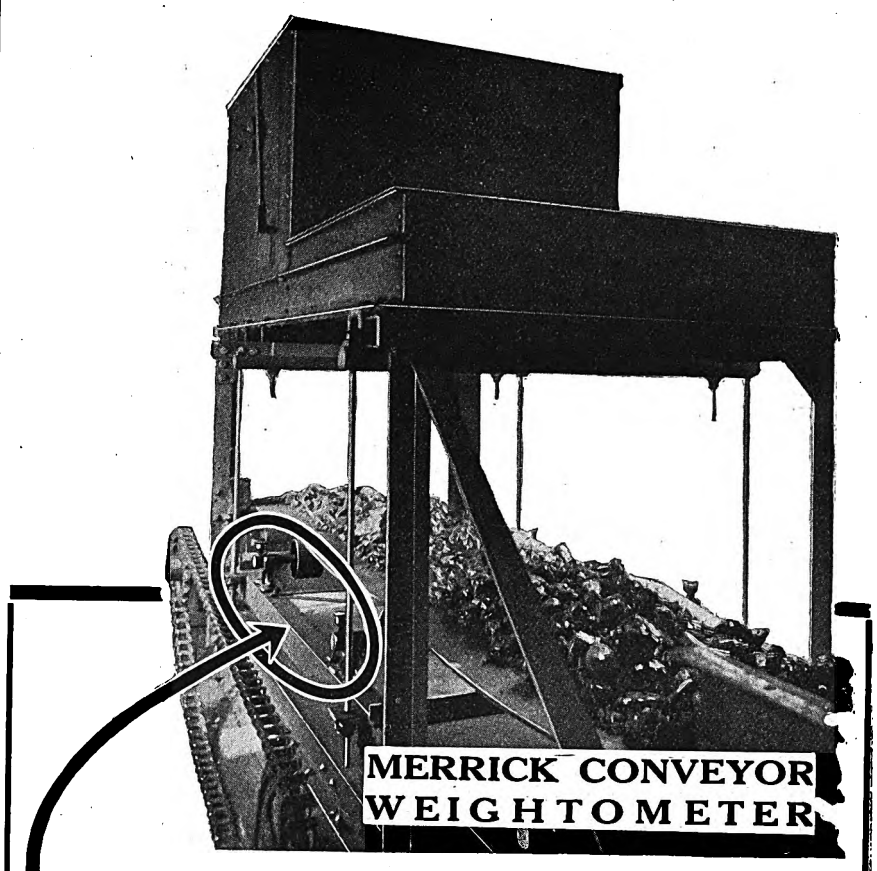
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HEATING AND VENTILATING
GENERATOR COOLING
AIR WASHING
FANS AND BLOWERS
STEAM ENGINES

Write for bulletins on air-handling problem that concerns you. We put at your disposal the knowledge acquired through forty successful years.

AMERICAN BLOWER COMPANY, DETROIT
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BRANCH OFFICES IN ALL PRINCIPAL CITIES (332)

American Blower

"Sirocco" EXHAUSTERS · VENTILATING FANS AIR WASHERS · BLOWERS · ENGINES
FOR HEATING, VENTILATING, DRYING, AIR CONDITIONING, MECHANICAL DRAFT



Right Here

is the Greatest Money-Saving Section of this Conveyor

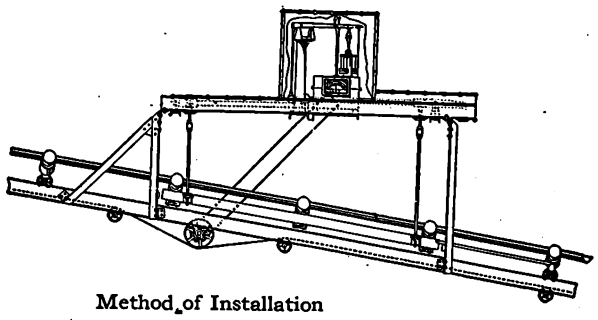
The Merrick Weightometer weighs all conveyor-handled materials ***while in transit*** and is ***guaranteed to be 99% accurate.***

No labor is required, as it weighs automatically and records the weight of the materials as they pass thru.

Send for the "Merrick Circulars," which contain graphic descriptions of the many types of installations. No obligation—glad to send them on request.

The MERRICK CONVEYER Weightometer

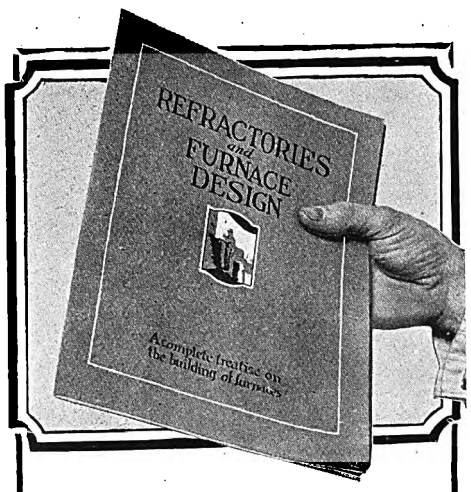
is in use in hundred of plants for weighing Coal, run o'mine and crushed; Coke, Stone, coarse and fine; Gravel, Sand, Cement Rock, Phosphate Rock, Phosphate Pebbles, Wood Chips, Sulphite Pulp Slabs, Fish and Fish Products, Ores, Etc.



Method of Installation

MERRICK SCALE MFG. CO.
180 Autumn St., Passaic, N. J.

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Here's a free book that may end furnace troubles

REFRACTORIES and Furnace Design is the title of this new furnace lining reference book. It gives information on weaknesses that have shortened furnace life, tells of troubles of the past. More important though, is the story that it tells of how modern monolithic construction with Plibrico Furnace lining corrects former furnace lining faults.

This book will tell how any man about the plant can install Plibrico to resist temperatures to 3100 deg. F—to cut down the loss of heat through the setting—to give two, three and even four years service without relining.

The knowledge gained from reading "Refractories and Furnace Design" may end the continual replacement of furnace linings that many engineers find necessary. Every operating man should read it and should keep it in his files for reference.

Do you want your copy of this treatise on the building of modern furnaces? There's no charge—no obligation. Just send the coupon. Your free copy will come by return mail.

Plibrico is delivered only in steel containers of distinctive appearance as shown below.

PLIBRICO FURNACE LINING
JOINTLESS FIRE BRICK CO.
1154 CLAY ST., CHICAGO

Jointless Fire Brick Co., 1154 Clay St. Chicago.
Please send me the 32 page booklet "Refractories and Furnace Design"—no obligation.

Firm.....

Address.....

.....

Name.....

Position.....

Ind. Ill. 10-23

(*Continued from page 56*)

erly trained and inducted into the plant.

The Training Department instructors have a kindly feeling toward their trainees even after they are promoted into the plant; and through a follow-up system they keep track of and advise each individual until they know the pupil is full grown and needs no daddy to advise him.

The saying—"Once a teacher always a teacher" holds good with an instruction force, and after they have passed through the Training Department and learned the Instructors' Trade—even should they go back in the plant departments as foremen or forewomen, or to higher positions, they will always insist upon teaching others.

It takes between two and twenty years to learn to become a machinist, according to the different minds of men. The old method of tossing a boy into a machine shop to be battled about for at least the first year, being left to absorb what he can in the way of knowledge, and gain what he will in the way of experience, is a system which has been relegated to the scrap heap, and placed in the Hall of Fame as a practice of the dark ages.

Today a young man who is ambitious, willing and with a good imagination can readily learn in two years through proper instructional methods, the fundamentals of the machinist's trade. This has been proven by performance in a large number of city and corporation trade schools. In view of the above fact, is it not just for us to acknowledge that the same type of boy who has missed his opportunity and grown into manhood, can and should learn some special tool job in as relatively a short space of time?

When the above is accomplished, the result will immediately be of great benefit to machinists and tool makers already trained, for it is going to provide for them an opportunity to advance, through a promotion system of instruction, to better jobs and better pay, for we must acknowledge that there is plenty of room at the top. The plan as worked out by the Training Department at the W. R. A. Co.,

(*Continued on page 60*)

Not What We Say, But What Others Say About B.B. Service

"Referring to the foundry building you have completed for us, we desire to say, that the work has been done very satisfactorily and quickly. You have performed your part to our entire satisfaction and strictly in accordance with the specifications. We know we have a first class job in evary detail."



"In the completion of the Garage and Service Station, which you designed and recently completed, you have established a record in our community in the erection of our building both in speed and design. We desire to express our satisfaction with the result of your efforts and together with the community feel very proud of our building."

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The BELING~BUSH CO., INC.
FACTORY ENGINEERS AND BUILDERS
Drexel Building Philadelphia Pa.

Rectigraph

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For Copying Machines
PRICES REVISED DOWNWARD

THE RECTIGRAPH COMPANY manufactures its own photographic copying machines and coats its own photographic paper, the entire plant being devoted exclusively to this line. Due to a lowering of the prices of some materials and economies effected in our new plant, we are enabled to announce normal prices on Photo-copying paper.

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8½ inch width	$10.68	8½ inch width	$12.96
9½ " "	11.93	9½ " "	15.84
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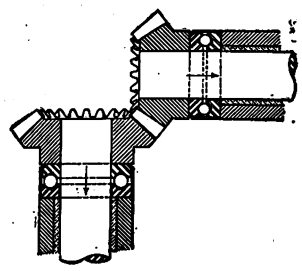
The RECTIGRAPH COMPANY has always regarded acceptance of an order as a pledge that it would be filled at the earliest possible date. The output of our plant belongs to our customers with orders on our books. This policy compelled us, during the past few years, to decline much desirable business which would have been highly appreciated, but this could not be considered without prejudice to previous connections. Improved facilities in our new plant enable us to increase production and quality and to decrease manufacturing costs. OUR CUSTOMERS WILL BENEFIT.

It is to your interest to become acquainted with Rectigraph Paper. We would be glad to receive your order for a sample roll, spooled to fit your photographic apparatus. You can then judge of its merits.

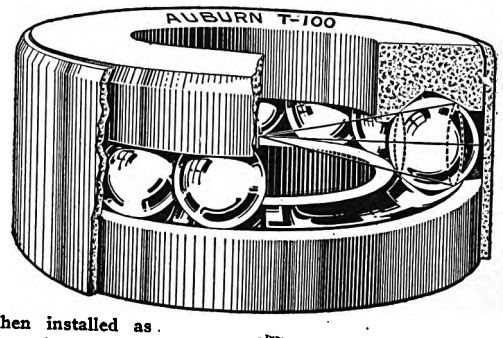
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BEVEL and HELICAL GEARS
run better with AUBURN THRUSTS



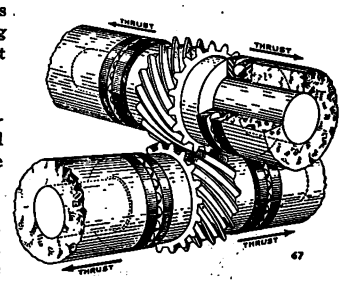
Bevel Gears



Auburn Ball Thrust Bearings when installed as shown keep Bevel Gears in proper mesh after long service, increase their life and assure more quiet operation.

Auburn End Thrusts, with their minimum of friction and wear, reduce the wear of other parts and insure a satisfactory performance of the whole machine.

Helical Gears operate with less power when Auburn Ball Thrust Bearings are used to take the end thrust as shown, by maintaining correct mesh of the gears throughout the life of the machine.



Helical Gears

Auburn Thrust Bearings or Collars when properly selected and correctly installed, maintain a uniform thickness due to their minimum of friction and wear, and thus reduce back lash and prolong the life of the gears. Send us particulars of your problem and let us aid you.

Steel, Brass and Bronze Balls

AUBURN BALL BEARING CO.

24 Elizabeth St., Trade Mark **Rochester, N. Y.**

Established 1893

MARBLELOID

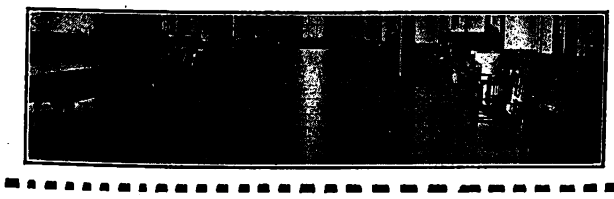
The Universal FLOORING for Modern Buildings

If you have in any office or industrial building a worn floor which needs renewing, the properties of Marbleloid fireproof flooring should interest you—because it is an ideal material for re-surfacing old floors whether they are wood or concrete.

This composition flooring is laid plastic over the old floor and in a few hours you have a strong, warm, smooth-surfaced, modern floor which adds much to the appearance, service ability and permanence of your building. This Marbleloid Floor will not dust or chip, will be found certain and elastic for walking and will not require any expensive upkeep.

We install each Marbleloid floor as well as manufacture the material and we will guarantee it to please you in attractiveness, longevity, warmth, strength and in all other qualities we claim for it. Let our engineers give you practical floor facts and send floor book. *Use handy coupon below.*

THE MARBLELOID CO., 467 Eighth Ave., N. Y.



THE MARBLELOID COMPANY, New York City: Without obligating myself in any way, please submit tentative estimates on the cost of your product installed complete for our building ..... below are the approximate areas involved.

Floor.....Sq. Ft. Sanitary Base.....Lineal Ft. Wainscot.....Sq. Ft. I have checked the floor troubles we now have.

Our floors are
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[ ] Cracking [ ] Cold [ ] Slippery
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Cuts the Cost of Reclaiming Coal

USED in conjunction with other equipment or used alone, the Scoop Conveyor is a mighty handy machine to have around for reclaiming or transferring coal from storage pile to boiler room.

It is ideal for loading small hand cars, electric dump trucks and similar equipment which in turn carry the coal into the boiler room. When the coal storage is not too far from the plant, two or more conveyors can be placed in tandem style, one feeding to another, and thus by feeding one machine the coal is delivered direct to the boiler room.

Well balanced construction permits extreme portability so that the machine can be easily moved about the yard.

Of course the same machine is used for unloading cars, storing coal and loading trucks or wagons. Any kind of coal, coke, ashes, sand, gravel, stone, etc., can be carried on the machine.

Thousands of users have found the Scoop Conveyor an extraordinary good investment.

Write for Catalog No. 158

Portable Machinery Co.,

PASSAIC, N. J.

ask any user

THE SCOOP CONVEYOR

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(Continued from page 58)

trained machine tool specialists as well as upgraded machinists and tool makers for higher positions. (See Fig 5.)

Observe any two men who are working together in a tool department of any large manufacturing concern. Johnson is forty-eight and Smith, thirty years of age. Johnson, the elder, is settled in his job as a tool maker; his bench is his horizon, he is a good, substantial workman, but has no ambition and lacks imagination; his week's pay and the little garden back of his house is all he ever expects to get out of life. He has a decent workman-like pride in his output, but his work consists in doing what he is told to do and being careful not to do too much, or to concern himself with matters that are outside of his special task.

Smith, the younger, finds himself assailed by doubts and fears; he cannot avoid thinking of the older man, and wondering if he is not likely to grow into the same condition of mind as the years roll by. Smith, the younger, does not like the prospect.

He has been studying nights, and would like to have some opportunity presented so he could train and advance beyond his particular job.

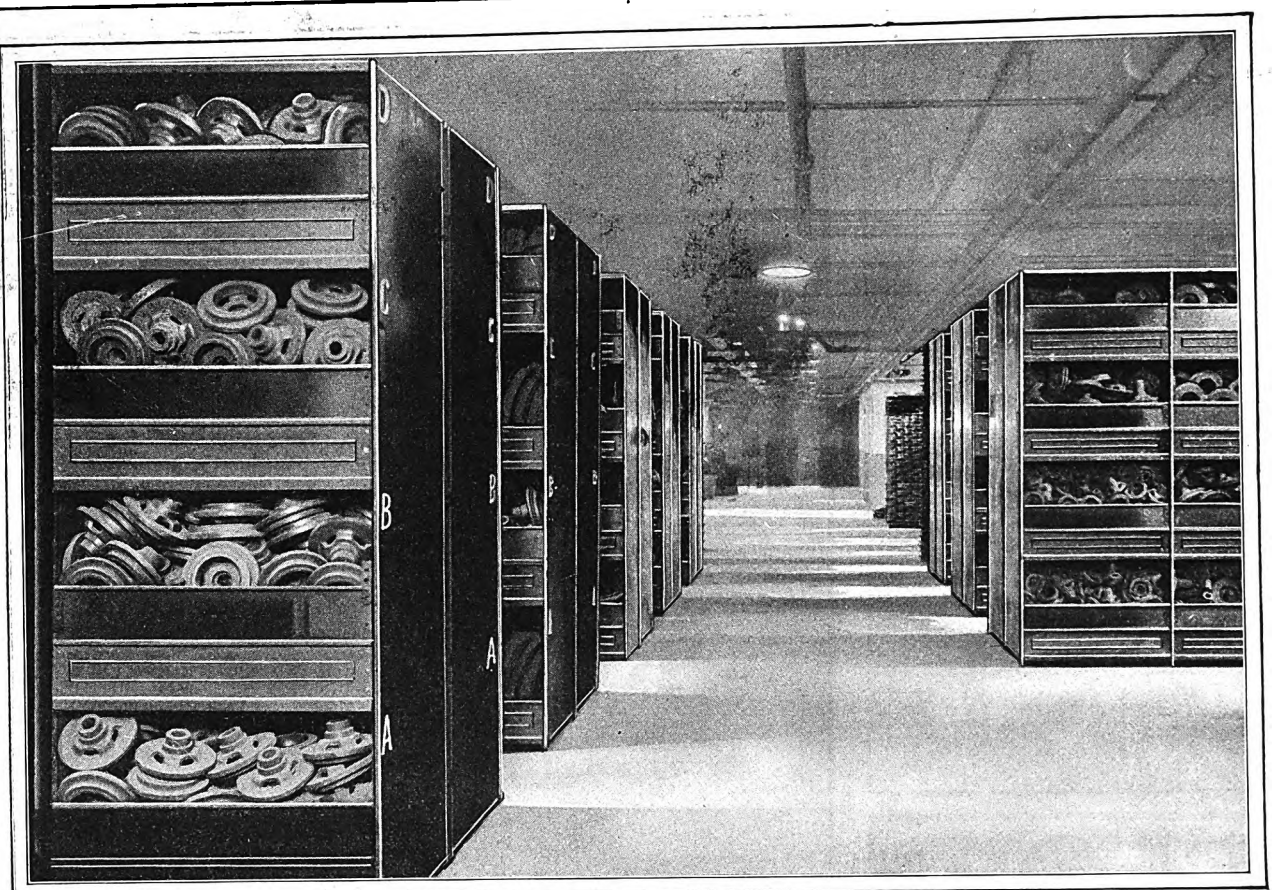
He wishes for a day of judgment to come in the plant when all minds would stand revealed, and everything be known by his employers so they might know what is on his mind. He quotes "what does it profit a man to become a better toolmaker than the rest?" He hopes that in some way the boss will find out what he wishes to do and open the way so that he can do it, but instead of that, what's on his mind is his own secret, and he feels that no one else will or can discover it. So his temptation is to settle back into his job and say to himself weakly "what's the use."

Such is not the condition in a plant operating a well thought out plan of training and upgrading mechanics. All that is necessary in order to gain advancement is to open the door and ask for the opportunity. The W. R. A. Co. upgraded machinists, tool makers and apprentices graduate to higher grade jobs such as blanking die makers, trimming die makers and die sinkers. There are a number of men now employed who were selected and given this opportunity to learn the higher class of work which brings them a higher wage. The places which were left vacant by these men had to be filled, and were therefore trained machine tool specialists as well as upgraded second and third class machinists, in order to fill in the gap left by those men who were advanced.

Training in industry need not necessarily be confined to the instruction of inexperienced people. Although this is perhaps its main object in busy times when help is scarce, the true measure of the value of such an undertaking is its worth during a period of years that represent a fair average of conditions.

Almost any manager, superintendent or foreman will admit that there may be some advantage in setting up a Training Department when that scheme offers the only

(Continued on page 62)



Eighty one tons of steel castings are stored on Lyon Standard Steel Shelving at the Brown, Lipe Gear Company, Syracuse, New York. Shelves carry a load of about 1500 pounds per bin. An excellent example of the great strength of Lyon Standard Steel Shelving.

Lyon Steel Shelving

—Endorsed by Industrial Leaders

TO be endorsed by the leaders of American Industry is the aspiration of many manufacturers — and the accomplishment of few.

For not many can meet consistently the rigid tests and exacting standards set up by those whose patronage is most sought for — not only because of its monetary value but also because of its prestige-building value.

It is a matter of pride to us that so many nationally prominent manufacturers have standardized on Lyon Steel Shelving.

But, to you, it is absolute assurance that you can depend always on the high quality of Lyon Steel Shelving and Lyon Service.

Perhaps our experience with the stores systems of so many large manufacturers may be helpful to you. If so, it is available to you without cost or obligation. Simply tell us you would like to have a Lyon Stores Engineer call on you.

Write us direct or the division nearest you. Your request will receive prompt attention.

Lyon Metallic Manufacturing Company

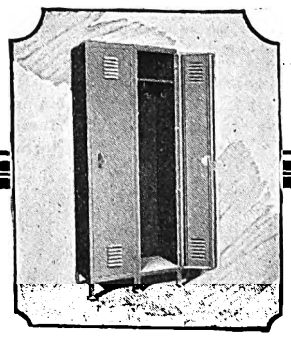
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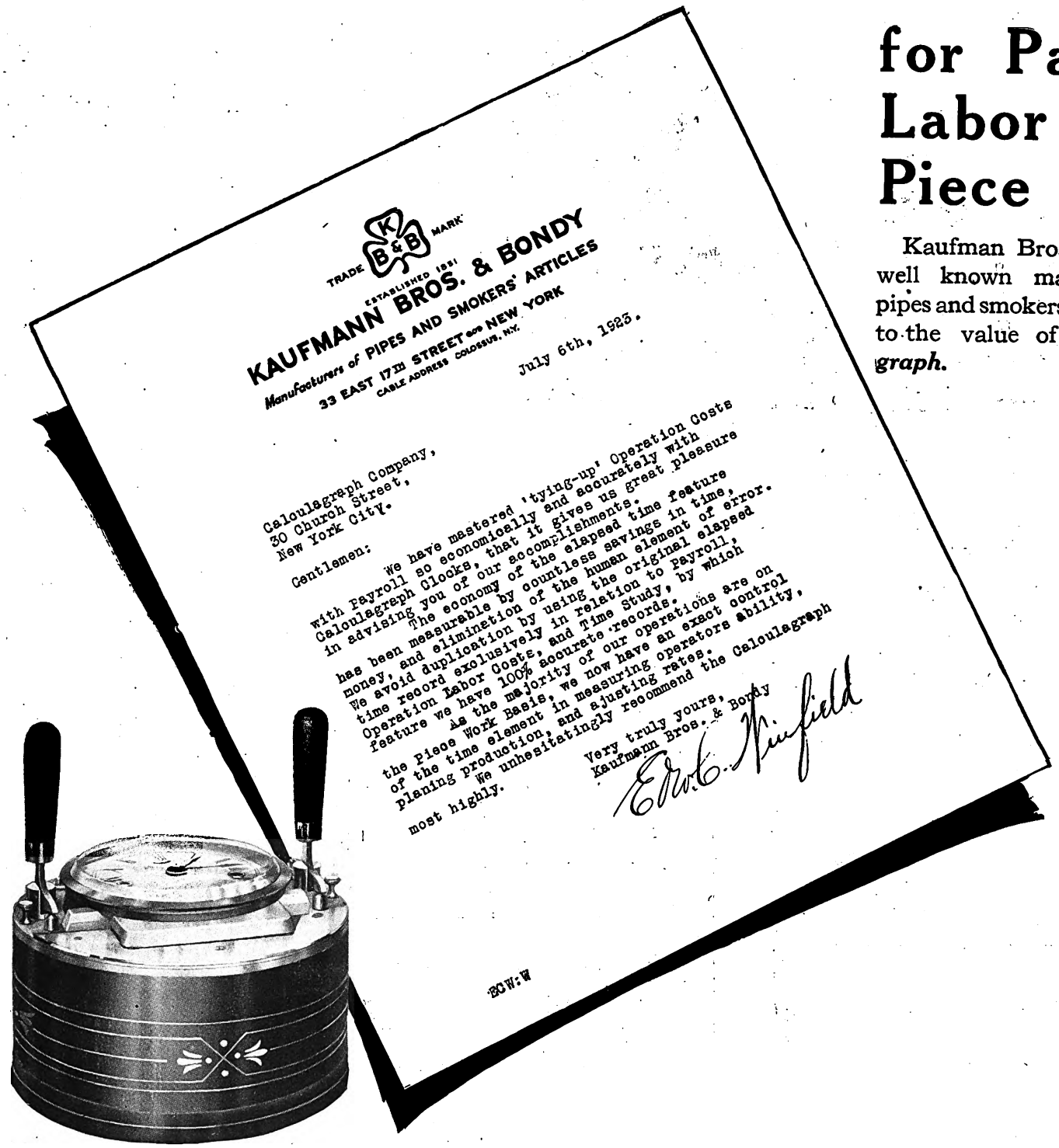


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They Use
CALCULAGRAPH
Elapsed Time Records



for Payrolls Labor Costs Piece Rates

Kaufman Bros. & Bondy, the well known manufacturers of pipes and smokers' articles, testify to the value of *The Calculagraph.*

THE CALCULAGRAPH COMPANY

34 Church Street — New York

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(*Continued from page 60*)

available means of obtaining more help, but naturally he wants to know what to do with the Training Department when the rush is over and help is more plentiful.

In most plants there are several grades of work, some comparatively simple and others more involved. Why not group machines doing the more simple work and route to them the same class of work they have been doing, using them as a starting point for beginners, then promoting them from this job to something more complicated, or to the same or more complicated class of work in the main shop?

The Training Department of the W. R. A. Co. has been run as a production factor from the outset. There are several distinct advantages to be gained thereby.

First, it avoids the scare which the trainee frequently undergoes when he is "pitch-forked" into the plant from the street.

Then again many employers have in their plants men who are willing workers and who maintain the proper mental attitude toward the employer, but whose efficiency falls somewhat short of the desired degree. The employer hesitates to discharge such a man and yet he feels that there is some doubt as to the advisability of keeping him. His problem in such a case is a serious one. It could be solved by placing such a man in the Training Department for a brief period until he has made suitable proficiency in his work. Both employer and employee would greatly benefit thereby.

Why is it that we take it for granted that everybody except ourselves need training?

Human labor is the most important single factor in our business lives. Why do we agree that fighters, racers, doctors, lawyers, engineers need training, and yet do not give our own shop boys the same chance to become expert in accuracy and speed?

In what other desirable way will you obtain *permanent lower costs?*

For photographs in this issue, not otherwise credited, we are indebted to the courtesy of the following:

MAKING THE EQUIPMENT FIT THE JOB

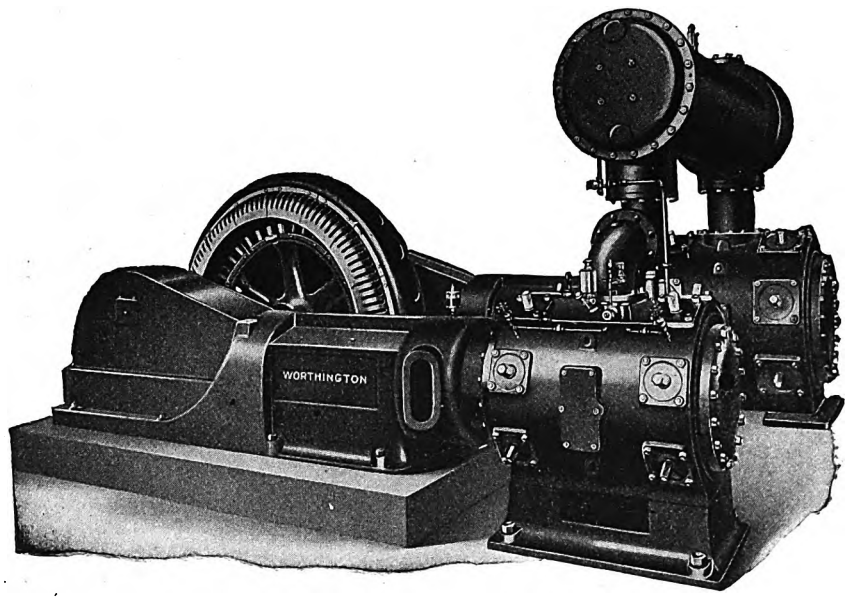
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WHY THE SUPERHEATER?

Power Specialty Co.
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670,000 HORSEPOWER OF ELECTRIC HEAT

General Electric Co.



. . . So They Asked FEATHER (Reg. U. S. Pat. Off.) Valve Owners

The Brooks Callaway Co., of Atlanta, Georgia, wanted an air compressor. They telegraphed several firms who had used Worthington FEATHER Valve Compressors and asked these users what they thought of their machines.

Here are the Replies:

We have two Laidlaw Feather Valve Compressors which are giving perfect satisfaction.

Concerning your wire of the twentieth, we have two Laidlaw Feather Valve Air Compressors manufactured by Worthington Company in service for two years which have given entire satisfaction.

We have 3,000 feet Laidlaw Feather Valve Compressors; three purchased 1915, three purchased 1920. Service exceptionally favorable. Maintenance very low. Efficiency very good.

We are using Feather Valve Compressors for air and amonia and giving repeat orders. We know of nothing better for a valve. The details of the rest of the machine should vary according to your particular service and price you wish to pay.

We have one 800 cubic foot steam-driven Feather Valve Compressor and one 3,000 cubic foot motor-driven compressor, operating at 120 pounds period with our conditions. Both machines operate very satisfactory.

Your telegram June 20th. We have found Laidlaw Feather Valve Compressor quite satisfactory and can recommend it.

Our operating experience with Laidlaw Air Compressors satisfactory.

Eleven Laidlaw Feather Valve Compressors has been generally satisfactory on this work for three years.

Our experience with Laidlaw Compressors and Worthington Pump and Machinery Company have been most satisfactory. Have nothing unfavorable to report.

Names of senders furnished upon request

WORTHINGTON PUMP AND MACHINERY CORPORATION

Executive Offices: 115 Broadway, New York City. Branch Offices in 24 Large Cities

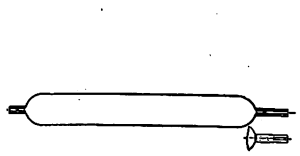
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WORTHINGTON

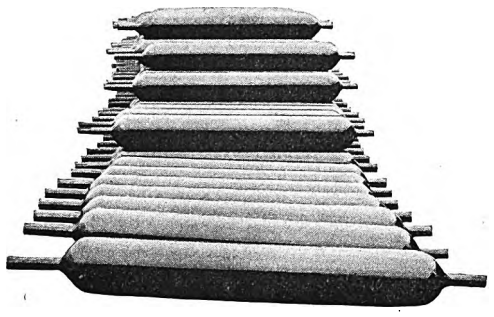
Deane Works, *Holyoke, Mass.*
Blake & Knowles Works *East Cambridge, Mass.*
Worthington Works *Harrison, N. J.*
Laidlaw Works, *Cincinnati, Ohio.*
Hazleton Works, *Hazleton, Pa.*
Gas Engine Works, *Cudahy, Wis.*
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Cross-Section Showing Hollow Construction



SEAMLESS DRAWN STEEL HOLLOW ROLLS

For Conveying Systems, Steel Mill Tables etc.

Because these rolls are light in weight they possess these specific virtues:

There is a saving in freight
They are easy to handle
Operating and power costs are reduced

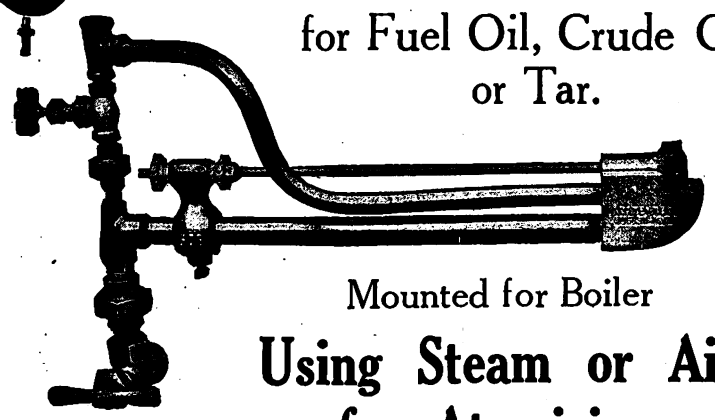
Built only on order to meet customers requirements. Submit your problem to us—send sketch or blue print and give dimensions required.

We are also manufacturers of short lengths of large sized seamless tubing to fit unusual conditions. The manufacturing experience of our several plants is at your disposal.

Wm. Wharton, Jr. & Co., Inc.
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30 Church Street, New York, U. S. A.
Cable address—Wilwharton

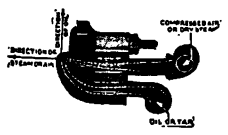
CALOREX Burners

for Fuel Oil, Crude Oil or Tar.



Mounted for Boiler

Using Steam or Air for Atomizing



CALOREX
Unmounted

Note direction of arrows. The air or steam meets the oil at right angles, thus thoroughly atomizing the oil externally. This prevents *Clogging or Carbonizing.* The burner is always clean.

WE HAVE been manufacturing liquid fuel burners for the past 33 years and we can safely say that the "CALOREX" is the most economical fuel burner to operate.

The "CALOREX" is simple in construction—no parts to wear out. It will last a lifetime.

It gives the most economical way to change boilers from coal to liquid fuel.

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W. N. BEST FURNACE & BURNER COMPANY
11 Broadway ENGINEERS IN CALORIC **NEW YORK**
There is nothing better than the Best



How Much Do Your Office Partitions Cost Yearly?

OFFICE space is costly. It averages from $2 to $3 per square foot. How much of this valuable space do your partitions needlessly occupy?

When Globe-Wernicke Counter Height Filing Cabinets are used there is no wastage.

These cabinets serve two purposes—each more efficient than the equipment they replace. They form a handsome counter of generous size and serve as partitions between departments.

Files for Globe-Wernicke Counter Height Cabinets may be obtained for any purpose—for correspondence files, card index, catalog, reference shelves or roller shelves for heavy books.

With Globe-Wernicke Counter Height Filing Cabinets there is the least possible amount of lost motion. The clerk remains right at the counter, selects from the files what he desires and uses the top as a table.

Save valuable space and increase your efficiency with Globe-Wernicke Counter Height Filing Cabinets.

Obtainable in either wood or steel of the desired finish.

The Globe-Wernicke Co.
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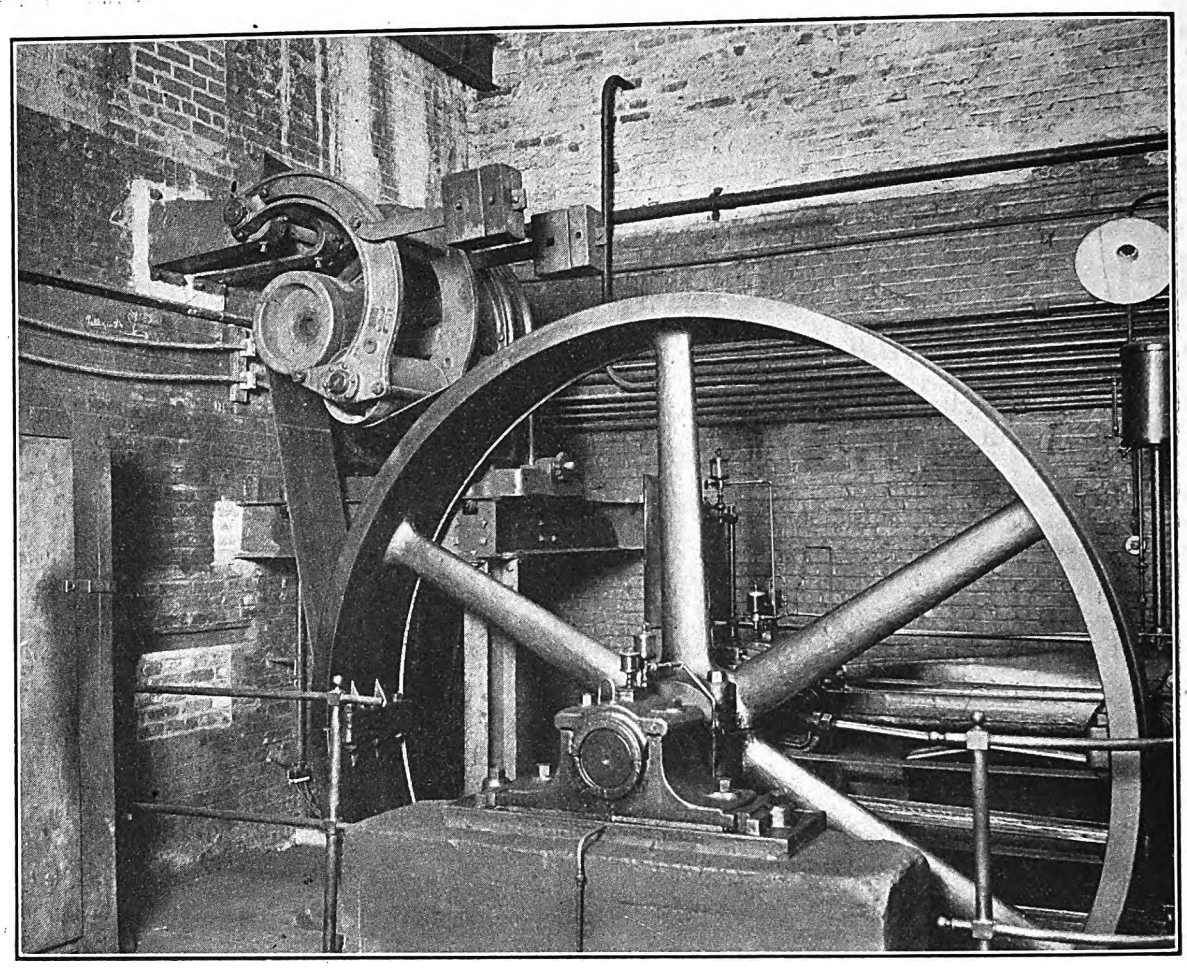
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THE LENIX DRIVE



Point Number Three—"Saving Floor Space"

The installation illustrated speaks for itself.

FIVE POINTS

1—The Lenix increases the arc of contact between belt and pulley.

2—The Lenix maintains constantly and accurately the proper tension in the slack side of the belt.

3—The Lenix saves floor space, building space and belting because of freedom in pulley locations.

4—The Lenix saves in bearing friction, lubrication and renewal of bearings because of reduced bearing pressure.

5—The Lenix permits the use of less expensive, high speed and high efficiency motors or generators because of the higher pulley ratios.

This 90 KW Alternator is mounted on a platform back of the steam engine fly wheel. The actual pulley centers are only 7'-6". The horizontal pulley centers are but 6 feet.

This alternator was originally mounted on the floor in what would be the foreground of the photograph, were we to show its original location. The patches in the brick wall above and below the Lenix show where the belt passed through the wall to a lineshaft in the next room. From the lineshaft the belt again passed through the wall to the alternator pulley. The alternator is now practically "hung on the wall," and the engine room floor is free of the alternator as well as of the rapidly moving belt, which formerly crossed it.

This installation could not be operated without the Lenix drive, and it is one of the many where the absolute freedom in pulley locations permitted by the Lenix is saving floor space—and belting.

Booklet: "Saving Slippage and Space" tells how it is done. Write for a copy.

F. L. SMIDTH & CO.

ENGINEERS

50 Church Street **New York, N. Y.**

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The Petroleum Industry in California

(*Continued from page 26*)

this organization. Capital was provided for the construction of pipe lines to transport the crude from the fields to tidewater near San Francisco Bay. A little later, as other companies grew up in the State, new markets were discovered and refineries were erected.

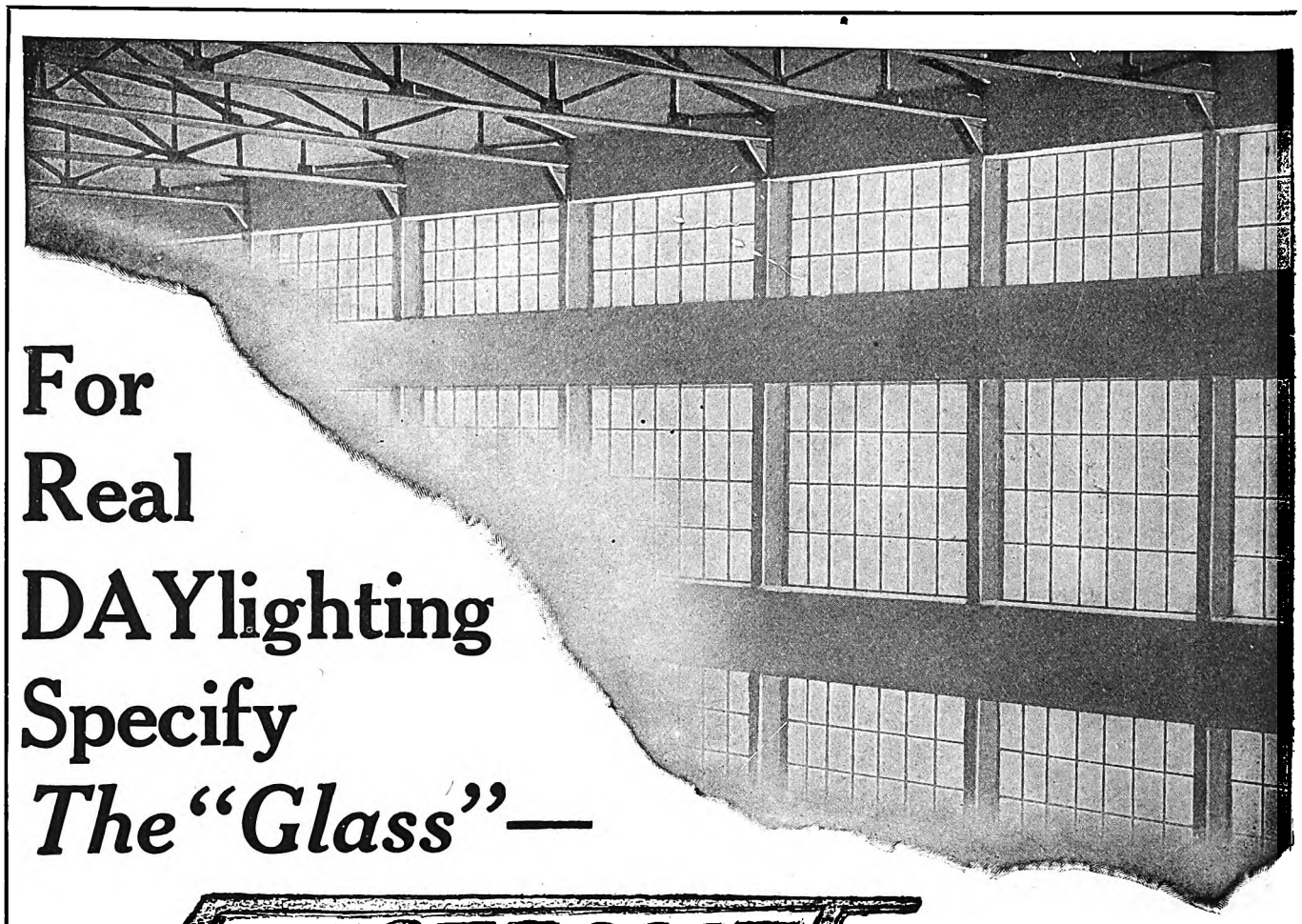
In many respects, the situation in Kern River in 1901 duplicates the over-production which followed competitive drilling of offset wells in the fields adjacent to Los Angeles. Much of this territory was held in small lots. Drilling was rushed for the purpose of developing and producing the oil which the operator knew would stay beneath his own property only as long as there was no well drilled near enough to his boundary line to cause the oil to migrate into the competitor's territory. Intensive drilling caused everyone to abandon the economic principle of leaving a fair proportion of recoverable oil in underground storage until the maximum profit can be obtained, and then bringing the oil to the surface by drilling wells spaced a maximum distance apart in order to secure the subterranean supply.

Where drilling takes place in congested areas, there is not enough oil underground, even in the richest districts, to yield a satisfactory profit for everyone when the cost of all the wells is considered. It must be remembered that even in ordinary times, drilling an oil well under conditions such as obtain in these fields, costs from $40,000 to $100,000, or more. Under conditions such as obtain in Southern California today, where labor and materials have been greatly advanced in cost, the total investment is unusually large.

It will help to make clear just what the contribution of the large corporations has been if we consider the type of organization necessary to control a typical "four-cycle" company engaged in all phases of the industry. Such an organization consists of a Board of Directors directly responsible to the stockholders. Under the supervision of the Directors' Executive Committee are the usual corporation offices, consisting of President, Vice-Presidents, General Manager, Treasurer and Auditor. Each of the four or five leading divisions of the industry will have its Manager or Superintendent. Thus, there will be one official in charge of the producing fields, another supervising the operation of the pipe lines, a superintendent of refineries, a head of marine transportation, and a sales manager.

Each of these executives builds up an organization adapted to the particular phase of the business for which he is responsible.

In addition to these large operating divisions, most of the oil companies in California maintain functionalized staff departments in charge of geology, marine transportation, purchasing, stores, engineering and construction, taxes and



For Real DAYlighting Specify The "Glass"—

FACTROLITE

By **reflection** from the plane surface of ordinary glass a great deal of daylight is lost. The prismatic surface of FACTROLITE **GATHERS** these daylight rays that are ordinarily lost (particularly in confined locations where light strikes the panes at a narrow angle) and **diffuses** them indoors.

When direct sunshine strikes on windows glazed with "FACTROLITE," the workers do not have to work in a blinding glare or to hang blankets or shades to check the sunlight. FACTROLITE gives perfect diffusion that eases eye strain on the workers nearest the glass and gives those deep in the building interior a clear **diffused** daylight to work in.

The U. S. Government recently used over 100,000 square feet of "FACTROLITE" for daylighting a huge building 300 ft. x 700 ft. The engineers tell us that you cannot see a shadow in any part of the big structure.

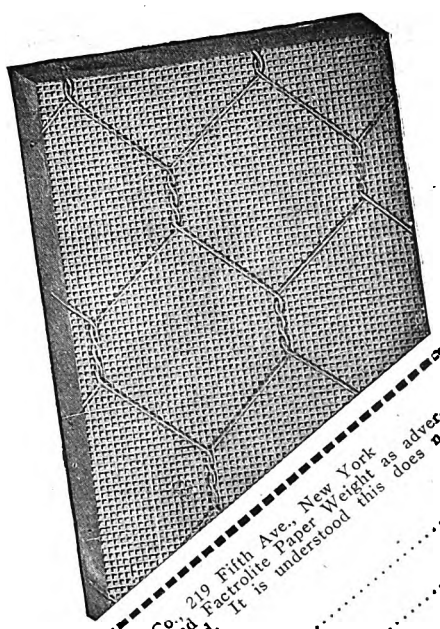
FACTROLITE is made both in plain and wire glass. Test FACTROLITE in your own laboratory.

A free sample will be sent to engineers who use the coupon.

Mississippi Wire Glass Company

219 Fifth Avenue, New York

CHICAGO ST. LOUIS



Gentlemen: Send me a Catalog and Factrolite Paper Weight as advertised in Industry Illustrated. It is understood this does not obligate me in any way.

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claims, and personnel. Separate departments may also be organized to take care of the telephone and telegraph system, legal matters, and statistics. The extremely important part played in the oil industry by such service and accounting departments is demonstrated by the fact that three of the leading companies of the state have recently erected very extensive buildings to house their general office staffs.

Organization growth has been directly affected by the pioneering nature of the industry. For example, many persons understand the contribution made by the geologist in locating new territory, but comparatively few appreciate the part which he plays in devising and improving methods of field operation. In California, the State Bureau of Mines and Oil maintains a staff of geologists and engineers who have contributed a great deal toward preventing the encroachment of water upon the oil sands. Their advice to the small operators having no geological departments, has proven especially valuable.

Some conception of what has been accomplished by the geologists of individual corporations may be gained from experience in the Kern River field. Nearly a million dollars were spent in that territory between 1915 and 1923 in an effort to shut off water flooding the oil measures. There are 2,170 producing wells in this territory. By carefully studying the drilling history and all subsequent work done on these wells, data was collected which made it possible to recommend a variety of corrective methods. The net result was a reduction of 1,575,800 barrels in the amount of water produced each month; that is, from 4,665,300 barrels to 3,089,500 barrels. In addition to reducing the water pumped by approximately 34%, the rate of decline in the production of crude oil was definitely checked, several properties showing practically no decline of production during the last three years of stable operating conditions.

No new well is drilled today by any large company without a very complete record being made of every formation through which the drill passes, and of all work of any kind done in the well subsequent to its completion. The geological departments maintain thorough records of every field, thus making corrective recommendations possible, which under the old unscientific method of operating without engineers or geologists, would have been entirely overlooked.

Both chemists and petroleum engineers have made strides tremendously significant to the industry. Nearly every large refinery now has connected with it a control and research laboratory. Several of these are well equipped with motor testing departments, where both fuels and lubricants can be tried out under actual operating conditions. In every division of the industry, well trained technical men, possessed of originality and courage, are at work on serious problems.

How far the experts have already gone in solving serious problems, how successfully the work is being attacked, may be

(Continued on page 68)

MAKE Him Understand
Say it with a Fence



"HIGH," unclimbable, and impregnable, an Anchor Post Chain Link Fence will enforce respect for your property rights.

It will prevent dumping on your grounds and afford protection against sneak thief, night prowler, troublemaker, and other dangerous trespassers.

Ruggedly constructed throughout. Fabric of heavy steel wire, No. 6 gauge. *Drive-Anchored* Steel Posts keep the fence in constant alignment. Every part *thoroughly galvanized* to resist rust.

The nearest A. P. office or sales agent will gladly give you complete information. Phone, write, or wire.

ANCHOR POST IRON WORKS
52 Church Street New York, N. Y.
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CHICAGO, ILLINOIS 8 So. Dearborn Street
CINCINNATI, OHIO 141 East Fourth Street
CLEVELAND, OHIO Guardian Building
DETROIT, MICH. Penobscot Building
HARTFORD, CONN. 902 Main Street
INDIANAPOLIS, IND. Lemcke Bldg.
MINEOLA, L. I., N. Y. 167 Jericho Turnpike
PHILADELPHIA, PA. Real Estate Trust Bldg.
PITTSBURGH, PA. 541 Wood Street
ROCHESTER, N. Y 48 Berry Street
ST. LOUIS, MO. 604 Lasalle Bldg.
Sales Agents in Other Cities



Anchor Post Fences
FIRM ~because anchored
PERMANENT ~because galvanized

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Made for maximum service not merely the average

TRADE JENKINS MARK

Jenkins Bros

Safe in Severe Service

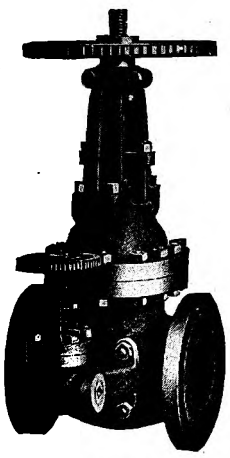


Fig. 389, flanged, Extra Heavy Cast Steel Gate Valve with By-Pass.

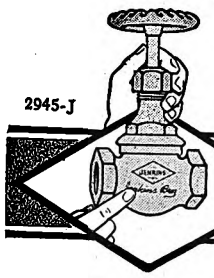
JENKINS Extra Heavy Cast Steel Valves handle superheated steam and high pressures with great safety. Every feature of their design has been carefully studied to produce easy curves and uniform thickness of metal in their bodies and bonnets. They are heavy, flawless castings having enormous strength and rigidity.

Where pressures and temperatures are high—where service is severe—they are absolutely reliable, perfect working valves.

Valves in bronze, iron, and steel for all requirements. At supply houses everywhere.

JENKINS BROS.

New York Boston Philadelphia Chicago
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Always marked with the "Diamond"

Jenkins Valves

SINCE 1864

THE TOWMOTOR

VS

THE LABOR SHORTAGE

CARNEGIE STEEL COMPANY

PAINTER MILLS,

PITTSBURGH, PA. April 28th-1923

The Towmotor Company
1226 East 152nd Street,
Cleveland, Ohio.

Attention Mr. F. W. Sears.

Gentlemen:

Replying to your letter of the 26th inst., beg to say that I am firm in the belief that there is a large undeveloped field for industrial tractors.

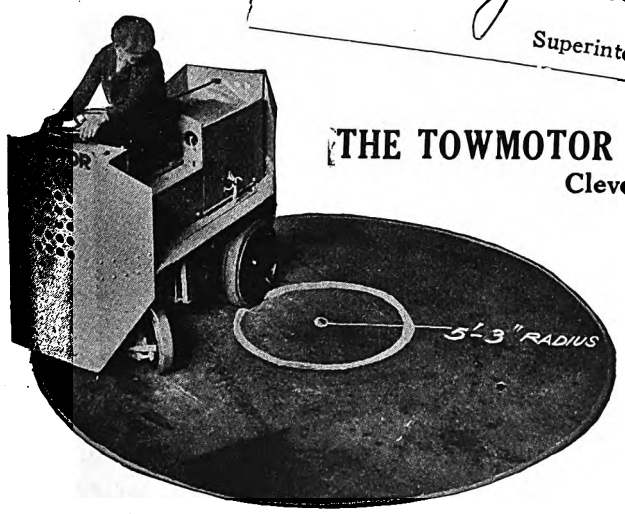
We are using two Towmotors in our hardest service in hauling steel from our yard to the Mills, over paved and dirt roads, and on an 8% grade.

This method is more satisfactory and much more economical than our former practice of teaming.

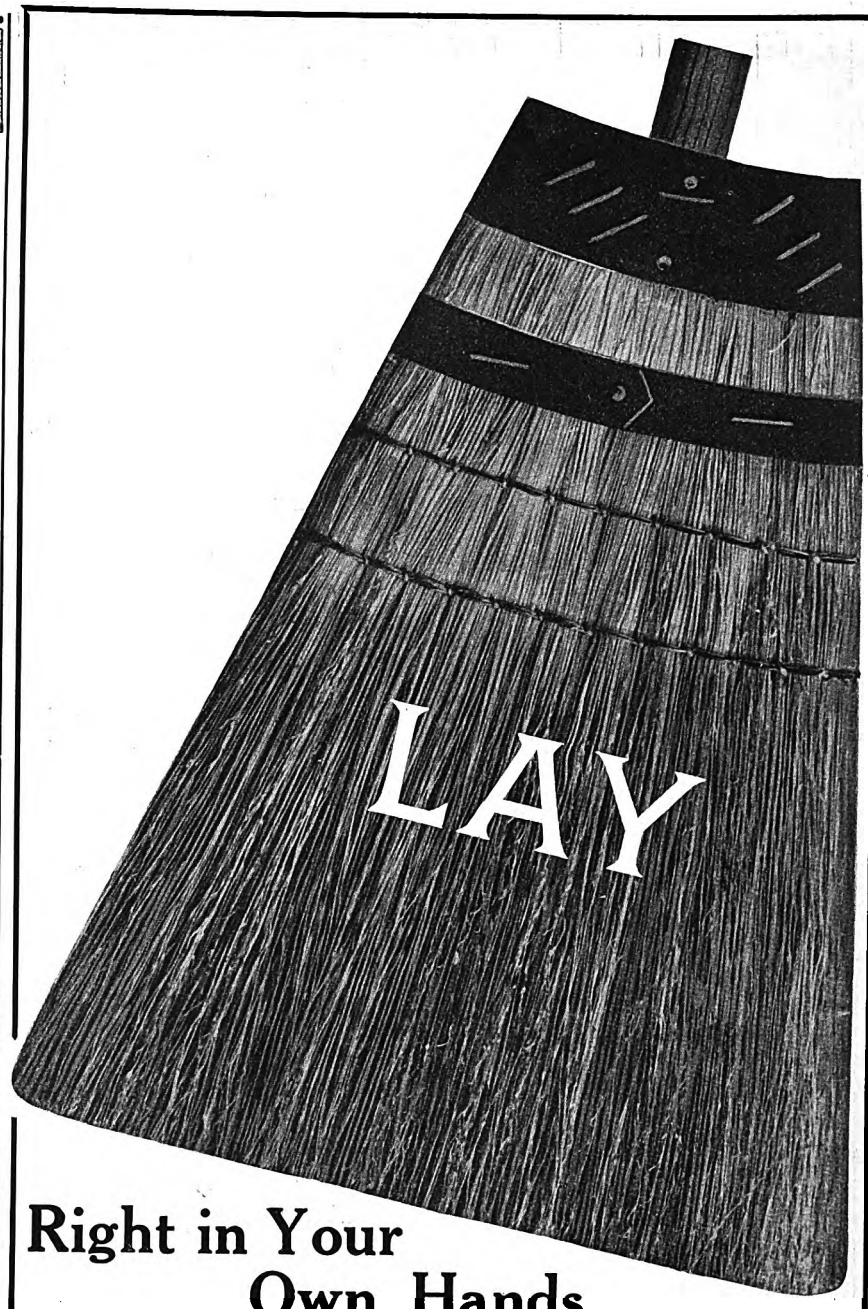
Very truly yours,

Signed: E. J. Dittmar

Superintendent.



THE TOWMOTOR COMPANY
Cleveland, Ohio



Right in Your Own Hands

—to examine—to pull the broom corn aside and see for yourself the tough strong center and evenly distributed fibres that give the Lay Metal Case Broom its long life in super-service. Test for yourself how firmly each fibre is held in the vice-like grip of staples—not nails—driven and clinched on both sides. See how perfect the balance, how sturdy the construction, and how flexible the extra wide sweeping tip.

And besides, our policy is to make brooms especially built for the different work demanded by different industries,—a textile broom for the textile industry, another type for the steel industry, another for the woodworking shops, etc. There is a design to do your job best; let us show it to you.

We are willing to pay all the costs of your test. If our brooms can't do your job better than any you have ever used, return our sample at our expense.

The Joseph Lay Company, Inc.

120 College Street

Ridgeville Indiana

Originators of the Metal Case Broom

Just send in this coupon showing your name, the kind of floors in your plant and the type of refuse our broom will have to handle.

Name .....

Address .....

Our floors are made of wood.....cement.....earth.....

and brooms would have to handle.....

We need special brushes for.....

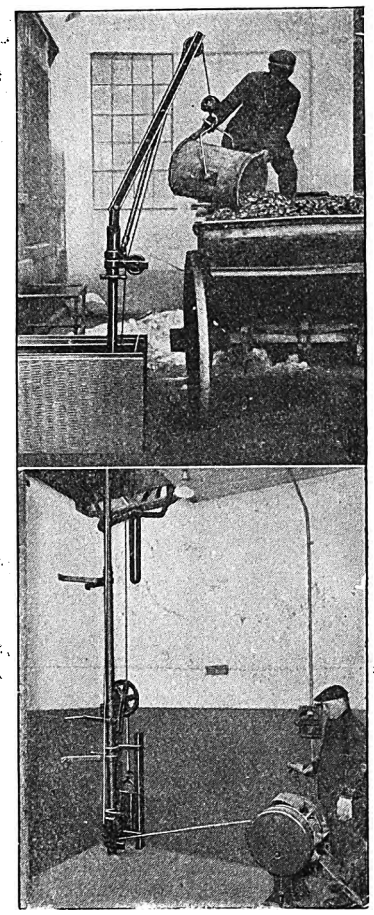


No. 256-144 Steel wire Push Broom | No. 412 Bench Brush | No. 28-H Bassine Whisk | No. 253-165 Base Push Broom | No. 3-W Steel wire Casting Brush

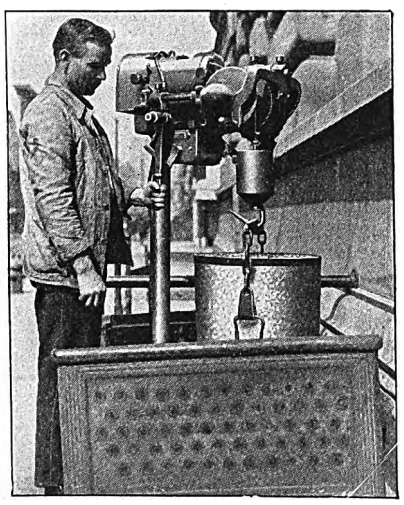
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In Factories, and large buildings where boiler room is below grade level—

The G&G ELECTRIC REG. U.S. PAT. OFF. Telescopic Hoist



Model D Electric G&G Telescopic Hoist at Mergenthaler-Linotype Co., Brooklyn, N. Y. Test showed 78 cans of ashes raised and lowered in 1 k. w. h.



Model E Electric G&G Telescopic Hoist in use at New York Telephone Co., (main building) Brooklyn, N. Y. Raises ashes at rate of 15½ tons in 1 k. w. h.

Offers the most dependable and most economical method for removing ashes.

DEPENDABILITY:

At the Albany High School, Albany, N. Y. a G & G Model C Electric Hoist has been in continuous use since 1913 and has met every emergency due to severe weather conditions during this long period.

DURABILITY:

At the Finance Building, Philadelphia, a G&G Model D Electric Hoist has been in continual use in this large office building for 8 years. Distance of lift is exceptional, being 48 ft. from boiler floor to grade.

FLEXIBILITY:

At the Hotel Grand, New York, a G&G Model E Electric Hoist raised 3500 cans of ashes in one continuous operation, the accumulation following a severe blizzard. The average daily ash removal is only about 35 cans.

ECONOMY:

At the main Long Island building of the New York Telephone Co., Brooklyn, N. Y., a G&G Model E Electric Hoist was recently tested for current consumption. Test showed that ashes are raised at the rate of 15½ tons (296) cans in 1 k.w.h. costing $.0348 or 85 round trips for one cent. The Bell Telephone System uses 86 G&G Hoists in its various buildings.

These are only a few instances of G&G ash removal performance. G&G Hoists are made in various models to meet the needs of all kinds of buildings.

For instance, G&G Ash Removal Equipment is in use in 626 industrial buildings, 604 office buildings, etc.

Write for illustrated Booklet No. **190**

GILLIS & GEOGHEGAN

556 West Broadway (New York

(Continued from page 66)

judged from reviewing a few of the outstanding developments of the past few years in the California fields.

In oil production, the most noteworthy development has taken place in drilling methods, where the rotary has largely supplanted cable tools. A few years ago, it was customary to drill wells almost entirely with standard or cable tools. The method of operation was by a power-driven walking beam, consisting of a heavy timber working on an axis. As the walking beam rocks up and down with a stroke of three or four feet, it raises and lowers the string of tools, their great weight giving them a striking force equal to that of a steam hammer.

The newer rotary system uses a perforated fish tail bit attached to a string of drill pipe, which passes up through the derrick platform. The top joint of the pipe is rotated by a turn-table at the rate of about 200 revolutions per minute. A swivel connection at the top of the drill pipe is attached to a hose, through which thin mud is pumped to the bottom of the hole. As the mud circulates, it carries out the cuttings made by the fish tail bit, and also serves to wall up the inside of the hole as drilling progresses. The hydrostatic pressure prevents caving of loose formations, thus making it unnecessary to use any casing until the hole is finished.

During the last three or four years, many improvements have been made in drilling equipment with the result that the rotary method is now almost universally applied in the California fields, the standard tools being used only in uncertain formations, or to complete a hole where conditions obtain which render the use of a rotary impractical.

An equally significant evolution has been taking place in pumping equipment. A few years ago, oil-fired boilers furnishing steam were almost universal well pumping equipment. On cold mornings, the steam rising from hundreds of wells was a characteristic sight in every oil field. Now, electrically driven motors and gasoline engines are the rule.

Wherever surface conditions and the location of wells will permit, jack plants are being installed. These are usually motor-driven, a forty horsepower, constant speed motor being widely utilized. By an arrangement of belts, countershafts and eccentrics, the pumps are operated by means of cables. In the installation of the plant, care is taken to balance the wells on one side of the plant with those on the other side, so that the pull on the eccentric is approximately equal in every direction.

The following figures show the comparative costs of operating individual motors and jack plants. The operating costs are averages taken for a large number of wells:

	Cost of Installing	Operating Cost (per well per month)
Jack Plant (25 wells)	$10.000	$10.00
Individual Motor	1,900	30.00
Gas Engine	1,900	60.00

Oil transportation methods have been developed along lines entirely separate from those used in transporting other kinds of merchandise. The necessity of moving tremendous quantities of a bulky liquid, some of the products being highly inflammable, and all capable of causing considerable damage to other commodities or of being seriously injured themselves by improper handling, have brought about the invention of a variety of unique methods.

The first extensive pipe lines were built in California in 1908, and the State now has in operation over 1,750 miles of line, the major part of which lies in the San Joaquin Valley and in the oil fields of Southern California adjacent to Los Angeles. The development of the electric welding process has made it possible to lay line much more rapidly and permanently than was possible a few years ago.

To surmount sales transportation difficulties, numerous special devices for the rapid transportation and safe storage of oil have been originated. Particular attention has been paid by construction engineers to the problem of preventing fires and explosions due to static electricity, in trucking and handling petroleum products. Special devices have been perfected to protect trucks both in operation and while being filled with inflammable products. All parts of storage plants and service stations

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there fires may arise from this cause are being bonded with heavy copper wires to enable atic accumulations to be carried off to the ground.

California now has fifty-four refineries with a daily capacity of 400,000 bbls. of crude. Several new refineries of large capacity are being erected not far from Los Angeles. The insistent demands of the motor driving public for gasoline have completely revolutionized refining methods. Only a few years ago, gasoline was the least valuable of several refinery products. Until the last few months, every energy was being bent to supplying it in greater quantities. Four means are being used to secure greater yield of gasoline from crude oil: first, blending the highly volatile natural-gas gasoline, or "casinghead," with less volatile refinery products; second, breaking up or "cracking" the lower gravity distillates, such as distillate fuel oil, to increase the yield of gasoline; third, general improvement in refinery efficiency; fourth, producing a gasoline of somewhat lower volatility, but well adapted for use in the average motor.

Due to the tremendous increase in production of high gravity crudes in the Southern California fields, the demand for increased yields of gasoline is not as keen as it was a few months ago. The State Oil and Gas Supervisor estimates that in 1922, California's production of crude above 20° Baumé almost equalled the entire 1920 production of crude oil of all grades, which was 105,700,000 barrels.

In March, 1923, it was estimated that the total daily production of gas in California was 580,000,000 cubic feet. Of this immense quantity, 275,000,000 cubic feet were said to be blowing into the air. Perhaps the greatest waste at the time was in the Long Beach oil fields where about 190,000,000 cubic feet roared into the air daily. This represents a daily loss of approximately 190,000 gallons of gasoline, since the gas in that field yields in the neighborhood of one gallon of natural-gas gasoline to each thousand cubic feet of gas.

No more striking developments have taken place in the industry in the last decade than in the recovery of natural, or casinghead, gasoline. Of all the gasoline manufactured last year in the United States, nearly 10% is estimated to have been casinghead gasoline. In 1922, California produced 693,497,000 gallons of motor gasoline and 53,707,000 gallons of "casinghead." About half of this natural gasoline is combined with crude oil and run into the pipe lines, thus losing its identity, while the remainder is used for blending and other purposes in its natural state.

Much interest has lately been attracted by the so-called "Jitney-Unit" extraction plants, making use of the Newton process. These plants vary in size from a capacity of 50,000 cubic feet of gas daily up to 3,000,000 cubic feet capacity. A plant of the larger size can be erected for $25,000. Operation is said to be so nearly automatic that a small plant can be run in spare time by the regular pumpers on the oil lease.

As the demand for economy

(*Continued on page 71*)



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(*Continued from page 69*)

operations becomes more intent, and as the industry comes constantly better developed and better organized, is nearly impossible to operate a successful refinery without producing lubricating oils, greases and other by-products. The economic condition developed in 1920, where all of the gasoline and most of the kerosene were necessary to support the cost of crude oil, with little or no margin of profit for plants not making lubricating oils. The differential in favor of the all-around refinery is said to be gradually increasing. Certain oil economists are of the opinion that within very few years there will be widespread failures of refineries running domestic crudes which are inadequately equipped for extracting a maximum of the various useful products from their raw material.

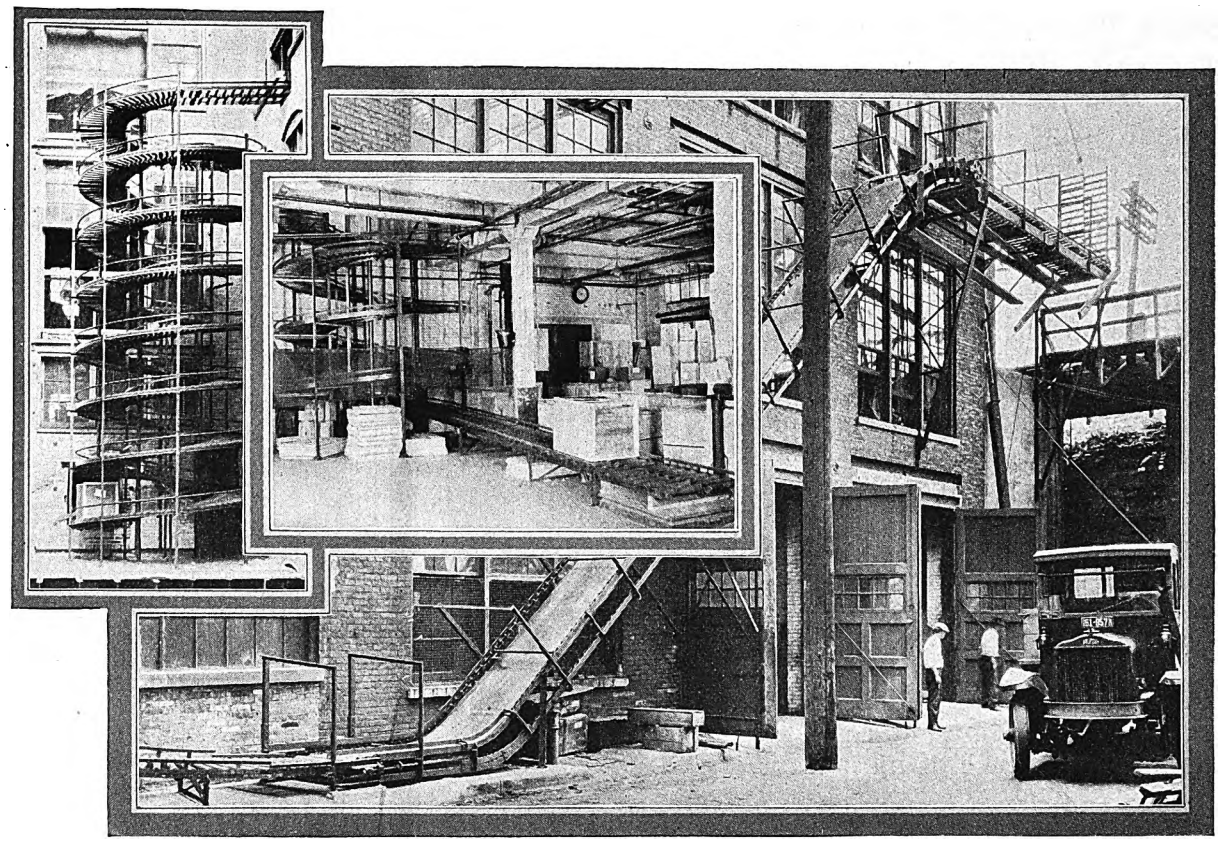
Over-production in recent months has led to an enormous increase in the available storage facilities. Hundreds of steel tanks and scores of huge cement reservoirs are being erected, and long disused storage has been filled to capacity. The total crude oil storage capacity of the State is now estimated at 85,000,000 barrels. On May 1, 1923, about 70,000,000 barrels were in storage.

One of the problems facing the oil industry at the present time is the serious losses which must of course be counted upon in this tremendous quantity of stored oil during the hot summer months of 1923. With volatile oils the loss is much greater than with heavy crudes, so the tendency has been to ship the lighter crudes to the eastern refiners, keeping in storage only the heavier petroleum which will suffer less waste through evaporation.

It is well worth noticing in passing that the growth in both the refining and production of oil in the State has necessitated the erection of numerous branch factories for the manufacture of machinery and equipment for Pacific Coast needs. Both Los Angeles and the San Francisco Bay district have profited by this growing tendency on the part of eastern manufacturers.

The oil tanker, always an important factor in the industry, is essential to operation in California. Producers ship oil up and down the Pacific Coast by this means and engage in extensive trade with the Pacific Islands and the Orient. More recently, the oil tanker has been the salvation of the industry in Southern California, making it possible to send shipments East to supply the demand created by the diminution in Mexican production. Tolls from Southland oil shipments in the twelve months ending May 1, 1923, equalled about two-thirds of the Panama Canal's entire income for 1922. In the four months ending April 30, 1923, shipments from Los Angeles passing through the Canal aggregated 13,346,000 barrels of oil. During April and May, 1923, shipments to Gulf and Atlantic ports of the United States averaged over 1,200,000 barrels of crude and fuel oil per week. The same period saw a weekly export to foreign ports averaging 360,000 barrels per

(*Continued on page 73*)



From Top Floor—to the Cars —with Savings at Every Step

CAN you picture a smooth, convenient flow of products through your plant without a lost moment in transportation, or any manual labor except for loading and unloading? That's what this Mathews Conveying System has done for the Burson Knitting Company of Rockford, Illinois. Mathews Carriers have eliminated all handling of goods by slow elevators, truckers and trucks, from the time boxes leave the packing room on the fourth floor, until they are stored in a freight car ready to ship. At every step in this installation a definite saving was made, both in handling time and in cost of trucks and labor.

Boxes open on two sides, ride with absolute safety on the spiral conveyer—centrifugal force and specially made double rollers keep them in perfect position. In the packing room Mathews equipment has added another point to economy. The open boxes can be closed, weighed and marked without removing from the conveyer. Some boxes are put away for stock, the rest are caught by the push-bar elevator outside the building and deposited on a freight car on the elevated siding above. Previously, a five-ton truck had to carry the shipping cases several blocks to a loading station.

Your handling problem may be simpler, or perhaps a great deal more complicated. But Mathews equipment can save for you as it did for the Burson Knitting Company, not only in speeding up material handling but in cutting many dollars from the pay-roll.

Apply these facts to your handling problem. Is there a place in your factory where Mathews conveyors could solve a similar problem for you and add many dollars to your profits? A Mathews man will gladly consult with you, or, if you wish, a catalog showing types of equipment adapted to every use will be sent you. A letter gives you prompt attention.

Mathews Gravity Carrier Co.

Ellwood City **Pennsylvania**

MATHEWS SPEED ECONOMY GRAVITY ROLLER CONVEYER

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It Can't Air-Bind!

When steam is shut off the Steam Trap Sarco opens automatically and stays open until steam is again applied—then the steam forces all the air out and closes the trap until condensation again opens it. No air or water can stay in the trap.

Consequently the Sarco cannot freeze.

Steam trap Sarco keeps the lines drained at all times. There is no big body of water in the trap to cool the steam and reduce it to liquid.

Has only one moving part. No levers, gauges, stuffing box, etc., to corrode or gum up and stick, and cause the trap to stay open and waste steam.

Can be screwed into pipe line at any angle and takes practically no space. No platform, pit or support needed.



Although the Sarco has many exclusive advantages, it costs but one-third the price of most traps.

Try a Sarco 30 days free.
Booklet R-36 sent on request.

Sarco Co., Inc.
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STEAM TRAP
SARCO

And Here are the Reasons

Utica
Non-shrinking tool steel.

SEMINOLE
Unbreakable chisel steel.

SILCROME
Non-corrosive electrical resistant steel.

DELHI HARD
A non-corrosive steel for a thousand uses.

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Unexcelled high speed steel.

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A better high carbon steel.

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Special non-corrosive steel.

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The edge holding tool steel.

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Tough a rustless easy cutting alloy.

LUDLUM STEELS
SPECIAL STEELS — SPECIAL PURPOSES
LUDLUM STEEL COMPANY — WATERVLIET-N.Y.-U.S.A.

Paint Up Now with the Multiblaster



Less than One-Sixth the Labor Cost

Your labor costs are at the least possible minimum when painting with the MULTIBLASTER. One man can paint 3000 square feet pet hour—equivalent to the work of six men. And one coat with the MULTIBLASTER equals two to three coats with a brush.

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Send for a MULTIBLASTER on 10 days trial. Attach it to your air line and try it out on any painting job. Pay for it only if it meets with your approval. Price—Paint Spray $12.00 F. O. B. Buffalo. Shipping weight only 3 lbs. Sent parcel post. Requires 40-50 lbs. air pressure. Send for it today. Write for prices on Multiblasters for Sand Blasting.



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68 Forest Ave., Buffalo, New York
Makers of Stowe Multiblasters for Sand Blasting
Multiblaster for Mechanical Application of Paint

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(Continued from page 71)

week, as well as a rapidly growing shipment through the canal of refined products. Oil in bulk pays the government about 14¢ a barrel in tolls. Nearly half of the present income of $60,000 per day earned by the canal is therefore derived from California oil. It is within the realm of possibility that California oil will make the building of a second Isthmian Canal, or the enlargement of the old one, necessary and profitable.

An inspection of California's oil marketing system reveals the same ingenuity, the same attention to engineering details, and the same determination to cope with the changing demands of the consumer, as are characteristic of other phases of the industry.

From the refineries, oil products are transported by tank car or boat to large industrial users and to hundreds of distributing plants located at strategic positions throughout the Pacific Coast states and the Orient. Each plant consists of storage tanks, warehouse space for drums and package goods, and facilities for loading the trucks and railroad cars by which deliveries are made to local customers.

Four of the large oil corporations and a number of smaller companies now operate their own service stations for the benefit of the motoring public. The first service station on the Pacific Coast was opened in Seattle in 1907. In common with all of the early "filling" stations, it was intended merely to dispense gasoline and had none of the numerous features devised in more recent years for the comfort and convenience of the motorist.

Every town of any size in the State now has several service stations operated by the larger companies. In addition, there are numerous privately owned service stations and hundreds of garages which sell motor lubricants and fuel. Competition is extremely keen, both in giving service and in making the stations as attractive as possible.

All of the leading oil corporations operating in California have paid special attention to their employees. Not only has oil proved one of the State's richest financial resources, but it has given opportunity to thousands for a useful and happy life. The oil fields are everywhere characterized by well-paid, well-housed employees. Through the efforts of the larger companies, and with the coöperation of the State Housing and Immigration Commission, the oil camps can scarcely be surpassed in comfort and sanitation.

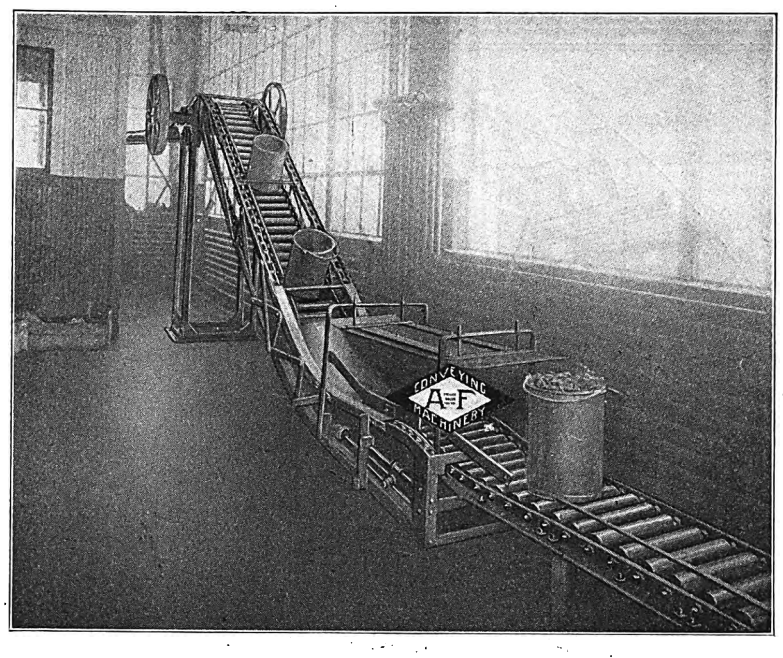
Taft, Coalinga and Bakersfield, in the San Joaquin Valley fields, are classed among the richest high school districts in the United States. The children of oil field employees have opportunities for the best of secondary school training. The influx of numerous young, well-educated men has put upon the industry a demand for further training. Several of the oil companies maintain extensive educational departments, and the high schools located in the producing fields have coöperated with the operators in offering both day and night courses for the training of oil workers. Both the University of California and Stanford maintain departments in chemistry, geology and petroleum engineering, in which excellent courses are offered for the training of young men desiring to play their part in the State's petroleum industry.

Stock selling, bonus plans or profit sharing have been used successfully as financial rewards by several of the corporations, thus furnishing a good basis for interest in work which has a natural appeal because of its place among the basic industries.

Safety work is being well developed everywhere. Six of the leading corporations recently coöperated in producing a four-reel film on this subject, which is now being shown to thousands of employees in California and is being displayed to oil workers and others throughout the United States by the Bureau of Mines.

In view of the startling, almost kaleidoscopic, changes during the past decade, one cannot risk much in the way of prophecy as to the future trends in the California oil world. Certain basic facts must, however, be clearly recognized by both investors and would-be regulators.

In the first place, nearly half



The Trail that Leads to Greater Production

These rows of sturdy rollers cut production costs and simplify interior transportation in thousands of plants.

Gravity does the bulk of the work—with practically no upkeep cost. A-F conveyors utilize waste space and go where truckers cannot work—over buildings, through narrow passages under roadways and direct to shipping platforms.

CONVEYING A-F MACHINERY

CONVEYORS

Are adaptable to every conveying requirement. They are economically handling products of every conceivable size, shape and weight.

The unlimited flexibility of the various types has led many far-sighted manufacturers to standardize upon complete A-F equipment.

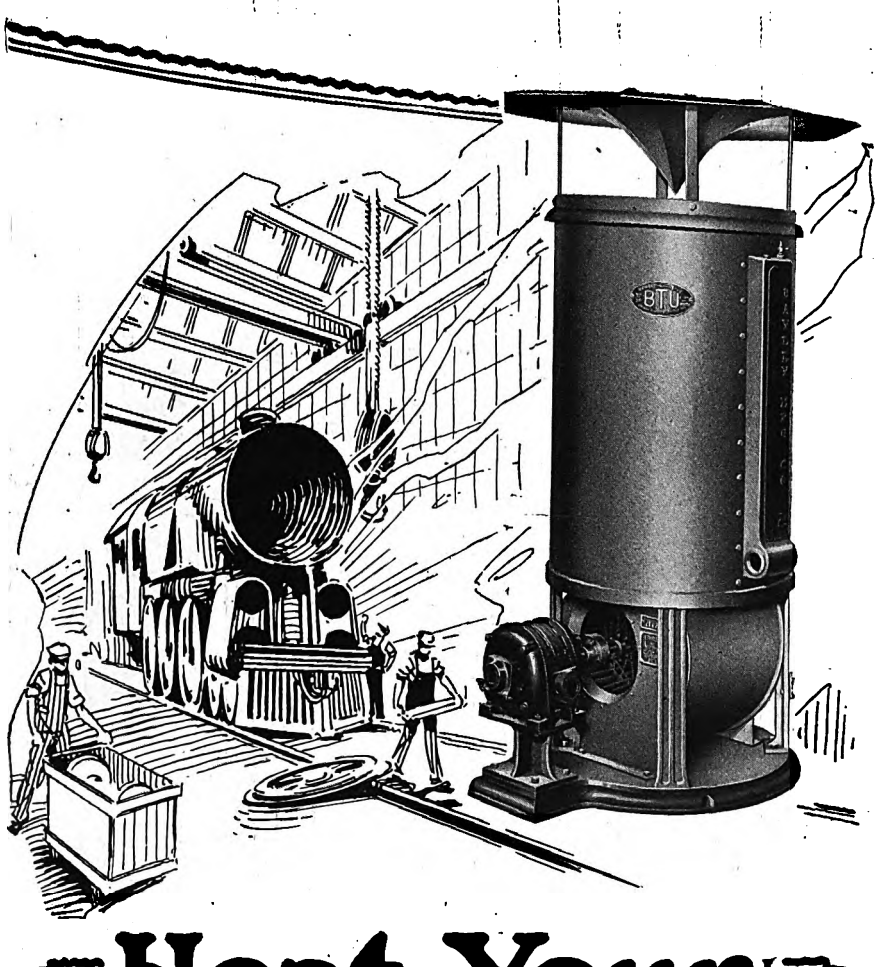
Apparently outgrown factories are now adequate for increased production through the installation of A-F Conveying systems.

THE ALVEY–FERGUSON ENGINEERING SERVICE

Alvey-Ferguson Engineers have solved seemingly unsolvable problems in plant transportation for years. Their counsel and advice is unbiased—Alvey-Ferguson makes all types of conveyors. A survey of your plant, resulting in definite recommendations places you under no obligation. Write today for complete information.

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Heat Your Factory

Evenly, Economically, Conveniently—with equipment that provides both heating and ventilating facilities that can be installed quickly and requires no distribution ducts.

The Denver-Rio-Grande Railroad

found itself confronted with the problem of providing efficient and flexible heating and ventilating facilities for its various repair and maintenance shops and solved that problem, after extensive investigations by purchasing and installing

43 Bayley B. T. U. HEATERS

The B.T.U. is a complete self-contained heating and ventilating unit that draws the cold air from the flooring through a series of steam coils and distributes the heated air evenly through the entire room. It is made of steel and iron throughout and requires no distribution duct system. Simply set on floor, connect supply and return piping and wiring to motor and it is ready to operate. Made with a variety of distribution hoods that make it especially suitable for heating industrial and railway shops and for temporary installations where properly distributed heat and flexible ventilating facilities are essential.

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Bayley Mfg. Co.

Dept. P. Milwaukee, Wis.

of the daily production of the State comes from a relatively small percentage of the total number of wells still capable of yielding a fair amount of oil. As the flow from these large producers declines, and as the richest yields are fully drilled, the familiar cycle must be repeated; smaller producers will be pumped again, and the extension of proven territory by drilling will be renewed to keep pace with market demands. The rate of decline of the wells in Southern California is known to be fairly rapid, but just how long the field will continue to occupy its present leading position in production is problematical. Sooner or later, the question of operating a large number of small producers under very economical methods must again come to the fore and all the attendant problems of engineering and maintenance will crowd for attention.

Not all of the money lost in oil has been spent on wildcat drilling. The erection of refineries has been overdone in Texas and the sad experience of that state bids fair to be repeated in California. New concerns are entering the field who do not appreciate that additions to refinery capacity made by the older corporations are merely part of a development program outlined months ago, a program not based on flush production from new fields, but upon the gradual growth of their own business and their faith in the future conservative output of carefully managed properties.

From the point of view of the small conservative investor, the stock of companies owning and operating pipe lines in good territory is likely to continue to offer an unusually attractive, but generally neglected, opportunity. This means of transportation is essential to the industry and will be expanded in California as in other parts of the United States.

Expansion of marketing organizations and of service and transportation facilities for sales departments will unquestionably occupy a foremost place in future activities. Means for increasing efficiency and encouraging economy in marketing must be found. As in other industries, present distribution costs are too large, partly because of the demands made by customers for service, and in part because the problems involved are too new to have demanded effective solutions.

The trench hat, the "old tin hat" that served in some measure to turn shrapnel hail on the war-swept fields of France, is coming into quite extensive use as a means of head protection against falls of rock and ore in the mines of California, West Virginia, Oklahoma and many other states, according to R. V. Ageton, metal-mining engineer of the Bureau of Mines, Department of the Interior. "The hats are being used in shaft sinking and in raising operations and around and in hoisting shafts," states Mr. Ageton. The "trench shoe" and similar heavy shoes are also being utilized by miners as a medium of foot protection.

Stiff protective hats are still widely used in some mining districts, but in general the custom of wearing stiff hats is not nearly so common in mines of this country as it should be, probably because a large proportion of the foreign-born miners, as well as many American-born miners, now come to the mines from other occupations, without previous knowledge of mining, and do not appreciate the importance of protecting the head and foot from minor accidents. In recent years, however, the Bureau of Mines has noted a gratifying increase in the use of protective devices for the head by the miners of this country. Many of the soldiers had been miners, and came back with a wholesome respect for the trench helmet and the trench shoe. After being discharged, numbers returned to the mines, and brought with them the trench hat and the thick trench shoes. As one miner in an Oklahoma zinc mine expressed it, "If 'the old tin hat' would stop shrapnel, I reckon it'll stop these small pieces of 'jack.'"

Both miners and operators have been quick to recognize the advantages of these wartime devices for mining use, and at least one mining company was so impressed that it bought a large quantity of trench hats and distributed them to its employees.

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The Aristocracy of Education

BY JOHN FLODIN

RECENTLY the expressions "Aristocracy of Education" and "Aristocracy of Brains" have been given considerable newspaper prominence and have caused much unfavorable comment. This last was to be expected. It is but natural that people who cherish the doctrine of equality would decry anything that threatens its sacredness, and all the more so if at the same time some real or imagined privilege of theirs was placed in jeopardy. But it is rather surprising to learn that so prominent an educator as Dr. Augustus O. Thomas, state superintendent of schools for Maine, should plead absolute equality. According to press reports, Dr. Thomas, in addressing the New England Association of Colleges and Secondary Schools, warned against "any propaganda which will tend to set up in this country, among our children, common and preferred classes." Dr. Thomas continued: "The tendency to select the 5 per cent. of superior mentality as college entrance is a false theory and a backwash of the caste system. We do not want even an educated few to be known as an educated aristocracy of America.—Education is not nectar to be drunk only by the gods. It is *aqua pura,* the drink of the masses of mankind. Education is for every one who may desire it.—"

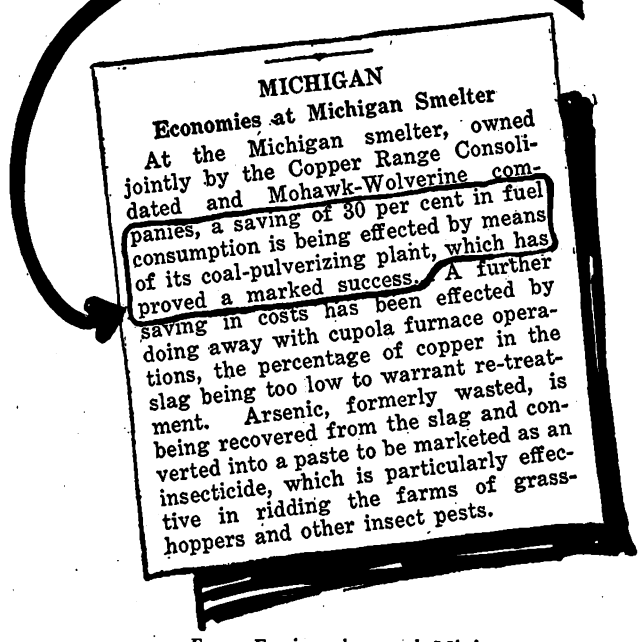
These sentiments are idealistic and perhaps they can be defended on the basis of some pedagogical theory. But from the practical, workaday point of view, would such wide, inclusive education, granting for the moment its possibility, be an unmitigated good?

Presumably Dr. Thomas does not wish to be taken literally. He, as a teacher, knows full well that every year there are a goodly number of children sent from grade and high schools to reform schools because of some mental twist that from the beginning of their careers separates them from their fellows. He undoubtedly knows that the educational institutions established for the feeble minded and mentally deficient are taxed to capacity practically throughout the country, and that many a subnormal child is kept in school—and this is true in most parts of New England—because there is no room or adequate provision for him in the reform or special schools.

Nature, then, is forcing on us a division into castes because of mental differences—differences that may perhaps

(*Continued on page 77*)

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Positions	*Number of Subscribers*
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Vice-Presidents	8,294
Treasurers	7,358
Secretaries	9,951
Controllers	1,496
Sales Managers	6,879
General Managers	6,225
Managers & Dept. Heads	37,187
Auditors	4,779
Salesmen	8,453
Superintendents	7,882
Advertising Managers	4,911
Accountants	7,690
Traffic Managers	2,675
Credit Managers	2,983
Bank Cashiers	3,142
Chief Engineers, Chief Draftsmen, Chief Chemists, Chief Metallurgists	2,513
Engineers, Chemists, Metallurgists, Draftsmen	18,119
Office Managers, Chief Clerks	12,529
Purchasing Agents	2,969
Professional Men	9,093
Miscellaneous	8,741
Total	201,067

Note that these are *busy* men. They were attracted to the Institute Course because a man's dividends from it begin *immediately*. It connects with your present position and problems like an extra locomotive connecting with a train. From the minute you begin with the reading you are conscious that a new force is working for your business and financial progress.

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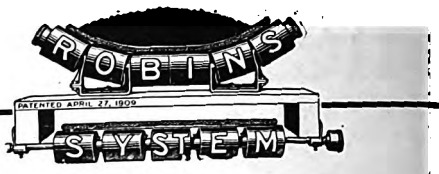
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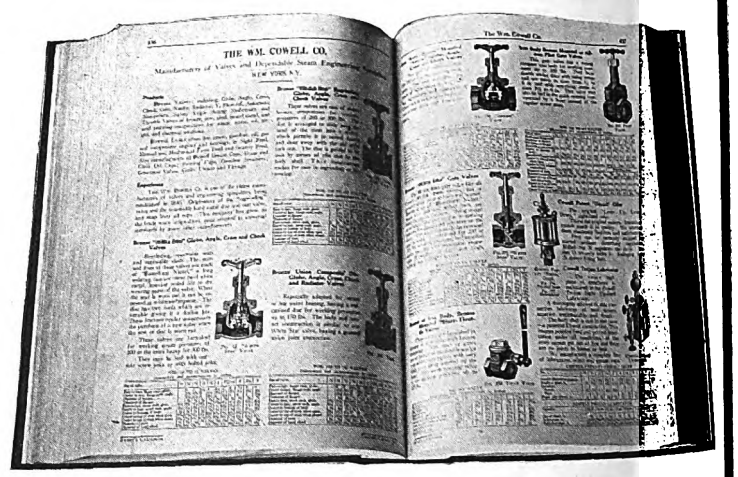
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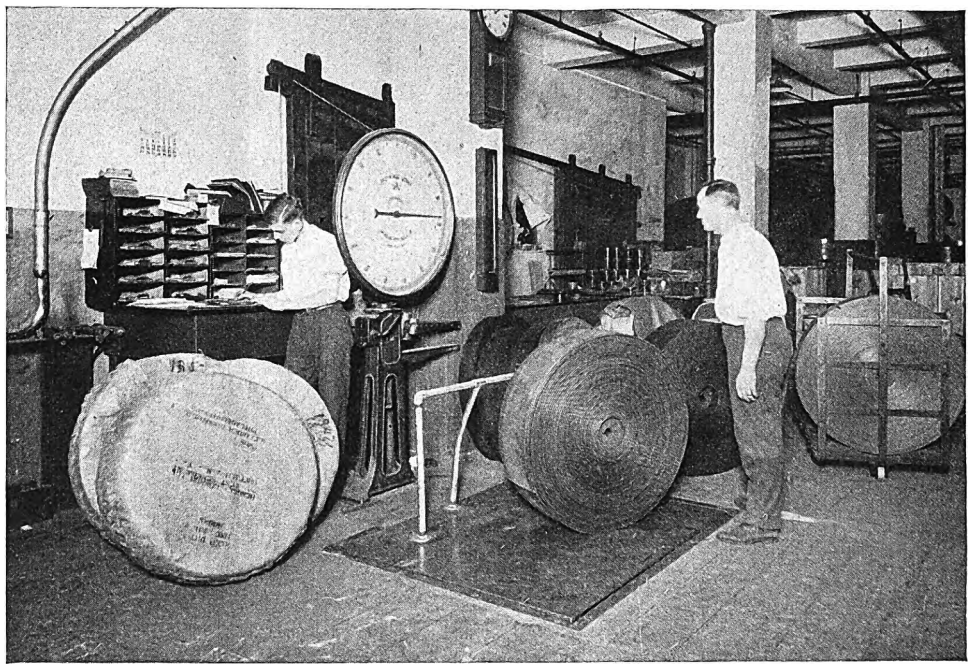
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(*Continued from page 75*)

be overcome when science learns to master mental defects and weaknesses. But that is Utopian; that is a thing to dream about, not to use as a basis for conduct or for serious discussion.

It may seem reasonable to leave the mentally deficient out of consideration, but where is the line to be drawn? Most of us know men who are college graduates and who yet seem to fall far below the level of an educated person, and perhaps even below the average intellect of people with much less school education. This may be partly due to faulty educational methods or to a faulty system, but it is at least in large measure due to over-education of persons who are not innately equipped to profit by the education offered and received. For even if we leave out of consideration all those who manifestly are unfit for serious study, we are still facing the problem of all those who perhaps could satisfactorily carry on the work and pass the examinations in high school and college, but to whom the learning imparted would be of no value. There are many who cannot apply what they have learned. There are many who can memorize and who can, in a manner, understand what they memorize, but who cannot truly assimilate their learning. The effect of higher education on them is often only to heighten their demands on life. They expect to be recognized and employed as men of ability, with all the privileges and the compensation due for ability, because they do not see the distinction between superficial learning and the ability that results when thorough education is built and superior innate qualities. And when they fail to make the expected progress they often become embittered and, what perhaps is worse, they become an example for hesitating, questioning, intelligent youths of the futility of higher education. Yet it is often people of just this type who clamor most loudly for equal opportunities in education. In many instances they could be far happier and far more useful to society if a greater part of their training had been of the practical kind we usually term experience. Unfortunately we are not yet ready to attempt to prescribe in detail just what kind of education or training every individual should have, nor how far that education should be carried, but in very many cases we can say with considerable amount of assurance whether further schooling will result advantageously for the individual and for society.

The nation can scarcely afford to educate men whose value does not increase commensurably with the education received. The cost of education is even now enormous, and it is growing at a rapid rate. The value of the time lost is incalculable. On the other hand, the state cannot afford to fail to educate men whose value may be immeasurably enhanced by proper education. This means that an aristocracy of education must be based on the natural aristocracy of intellect, and that it is the business of every educational system to establish as its ideal the training of all people in accordance with their intellect, ruthlessly discarding the fal-



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lacious doctrine of equality.

Perhaps an illustration will make this point clearer. Three years ago, while visiting Finland, I met two men, both of whom had been subjected to the regulations of the educational system of that country. One of them—he was about forty years old—was the son of a man of considerable wealth and influence as well as of high cultural attainment. The son, however, did not measure up to the requirements. He flunked out of college, nor could all the influence of the father win him admittance to any other educational institution of higher rank than trade school. The boy finally became a machinist, and when I met him he was in charge of a large machine shop, evidently satisfied that he had found his proper sphere in life, and evidently giving very satisfactory service. The other man was 45 years old, the son of a farmhand. From the first year of his school life the boy was without money, without friends, without influence, but possessed of a high order of intellect which was duly recognized. From the country grammar school he was sent, at state expense, to the high school in a near-by town, later to the university at Helsingfors, and finally abroad for several years of further study. The state, through its educational system, had recognized his superior qualities, and had seen to it that his aristocratic birth-right was not denied him. This man is today considered a high authority on bacteriology, and the increase in his value to the country has undoubtedly been well worth the expense and the forethought expended not only on him but also on others who may not have so fully justified the expectations of those in charge.

This, it should be remembered, was in a country where the feudal inheritance of aristocracy still was an established and cherished institution when these two men were young. Yet no tradition of aristocratic birth, nor any notion of the power of wealth, was allowed to interfere with the ideal of an aristocracy of intellect. To what extent this ideal may be recognized in other countries I do not know, but it is well to remember that all, or nearly all, European countries have systems for granting state stipends for study at home or abroad. Even Japan is spending large sums for the purpose of having the most promising members of the rising generation as highly educated as possible, while we in the United States, who are wont to regard our civilization as of a higher order, leave the matter of stipends to philanthropy.

It should not, however, be our ambition to copy what may have found popular favor, elsewhere, nor yet to continue along a path into which we may have drifted for no better reason than that staying on that path means pleasing a majority of which the aristocracy of intellect is not a part.

It is a well-known fact that the students set the standard of proficiency in American colleges, and that that standard in most instances is lower than the standards in European schools of equal rank. I do not mean to say that the value of the education offered in this

(Continued on page 81)



If You Had to Wear Your Overcoat in Your Office

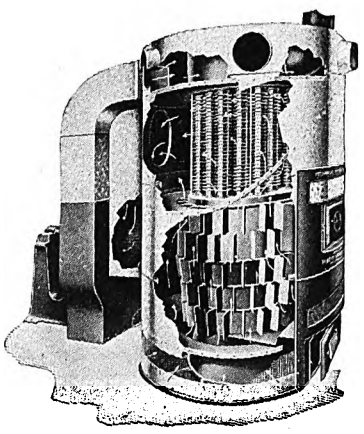
—you would be more interested in keeping warm than in working.

If your employees are forced to work in a cold, drafty shop, they can't deliver all the work of which they're capable. Like you, they pay more attention to personal comfort than to production working—it 's only human nature.

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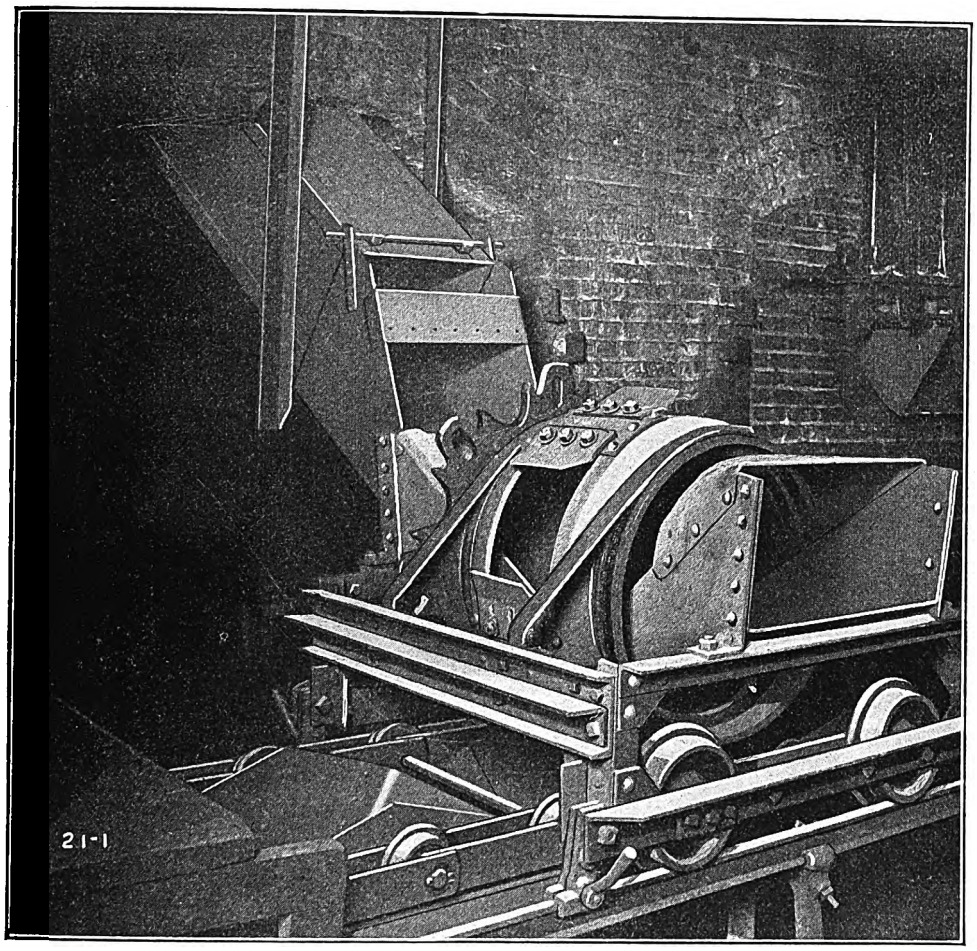
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When Coal Was a Nuisance

"In the year 1306, coal was so generally used in London that a petition was sent to Parliament to have the use of it suppressed on the ground that it was a NUISANCE."

From an Article by Elisha Gray in "Modern Achievement"



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The buckets are loaded by a filler of the revolving drum type, which is driven from the conveyor chain, through a wheel designed to properly engage in the links of the chain. The filler moves in perfect synchronism with the conveyor and gives an equal charge to each bucket, filling each bucket to capacity without spilling the material over the edges or between the buckets. It furthermore prevents dust and grit from getting into the working parts of the conveyor.

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CAN any reader of these lines imagine that this commodity, absolutely vital to the industrial life of today, could be held in such little esteem by the Londoners of the twelfth century as to "have its use suppressed" by act of Parliament? It is inconceivable!

Today the exact reverse is true when the entire National, State and local Governments, are importuned to pass drastic laws to compel a sufficient supply of what was once termed "a nuisance."

That the meagre stock now available and the coal that will eventually reach the consumer, on the termination of the coal strike, will demand exorbitant prices is quite understood; then why make the handling and rehandling of what is received, more costly by the use of obsolete or inadequate methods or apparatus?

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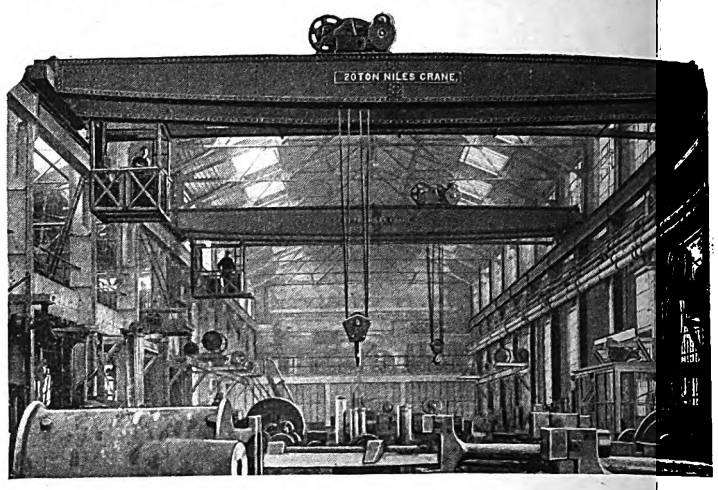
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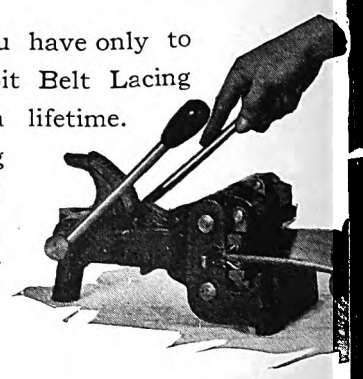
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(*Continued from page 78*)

untry has been seriously paired by this state of ngs, but I am firmly con-nced that the more we adhere the doctrine of equality the ore difficult it will be to main-n reasonably high standards. is is a more serious matter an it may seem, for the more e standard of intellect and of nolastic attainment is low-ed, the more will those be ld back who are made of a er clay.

The squelching of the eager-ss of the brighter youths ay not be entirely avoidable, t surely it should be recog-zed as an evil that should at ast be held in check as far as ssible. Yet there are many stances where the equality ctrine is applied so indis-iminately as to all but defeat e purpose of the education fered. This happened, for ample, recently in an eve-ng class given in Boston un-r the auspices of the Univer-ty Extension of the Com-onwealth of Masachusetts. he work of the students who anted to take the course to tisfy a real need, and who ere mentally qualified to pro- by the instruction they rea-nably could expect to receive, as so hampered because of e low standard of the class at many of them dropped t, some of them regis-ring for a similar course ven in a suburban town here the other students appened to be on a higher tellectual level. Naturally, e instruction given in the oston course had to be modi-ed to suit the majority in the lass, for to raise that majority a standard established eforehand was manifestly im-ossible. No doubt the class rofited to some extent by that ourse, but the gain, from the arger, social point of view, an have been but slight as ompared to the loss sustained y those others who might ave profited immeasurably f the standards of the instruc-ion had been high enough and igid enough. There is a real anger in this. It is robbing eter to pay Paul, but giving aul only a fraction of what eter had to sacrifice. And eter's loss is the Nation's oss—the loss of an aristocracy f educated intellect.

THE recent drastic reductions in the prices of gasoline are the natural consequence and expression of a situation which has been in process of development for at least two years. Over-production of oil during this period, and the resulting accumulation of stocks of crude petroleum and its products, have been regarded with growing concern.

Clearly, relief must be sought either in reduced production of crude oil or in increased consumption of oil products.

From the standpoint of the public, restricted purchasing by the refineries would appear to be preferable in the long run to the price-cutting which has actually taken place. Any excessive reduction in the prices of petroluem products is unfortunate in that it unduly stimulates consumption and hastens the depletion of the already rapidly disappearing resources of the country.

(The Guaranty Survey)

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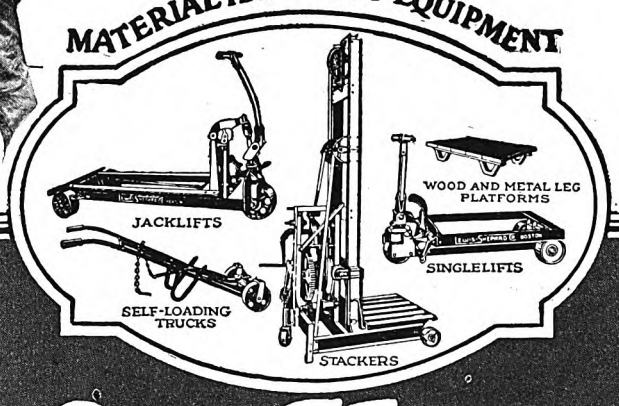
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Industry Illustrated

Men, Methods and Machinery of Modern Management

Reg. U.S. Pat. Off.



"What About Maintenance?"

(See page 7)

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TRUSCON PRODUCTS

both build your factory *and* convey materials at lowest cost



$5084 will erect this Truscon Copper Steel Building, exclusive of floor and foundations, in average locations east of the Mississippi. This is a Type 2 building. Width, 50 ft.; length, 100 ft.; height, to eaves 10 ft. 9 in. This low cost is typical of all kinds of Truscon Standard Buildings.

This building includes:—steel framing; 18 gauge copper steel roofing and siding; 33 ventilating Truscon steel windows, three lights wide and five lights high, 14″ x 18″ glass size (glazed complete); three rotary head ventilators in roof; two 8′ x 8′ steel sliding doors, two leaves each with tubular rails, styles, steel panels and glazed sash, with necessary hardware. Price includes one shop coat of paint, glazing and erection. Heating, lighting and other equipment not included.

Send for Full Information Ask for prices on other buildings. We furnish these buildings in all sizes with pitched, monitor and saw-toothed roof, and with any desired arrangement of windows and doors.

Truscon Copper Steel Standard Buildings are the product of the largest organization in the world specializing in fabricated steel building products. Made in the great Truscon factories, these buildings have now reached a high point of development resulting from applied engineering experience and specialized study of the requirements in every field of building endeavor.

Truscon Copper Steel Buildings provide everything desired in permanent, fireproof building construction for all one-story and many two-story needs - and at lower cost than any other fireproof construction known.

The large, standardized units, from which these buildings are made, are quickly erected by a few men in contrast with quantities of brick, cement, sand, sash, frames, etc., requiring many workmen of different trades. Hence, an 80% saving of labor and a greatly increased speed of erection. Your occupancy is assured in half the time of ordinary construction.

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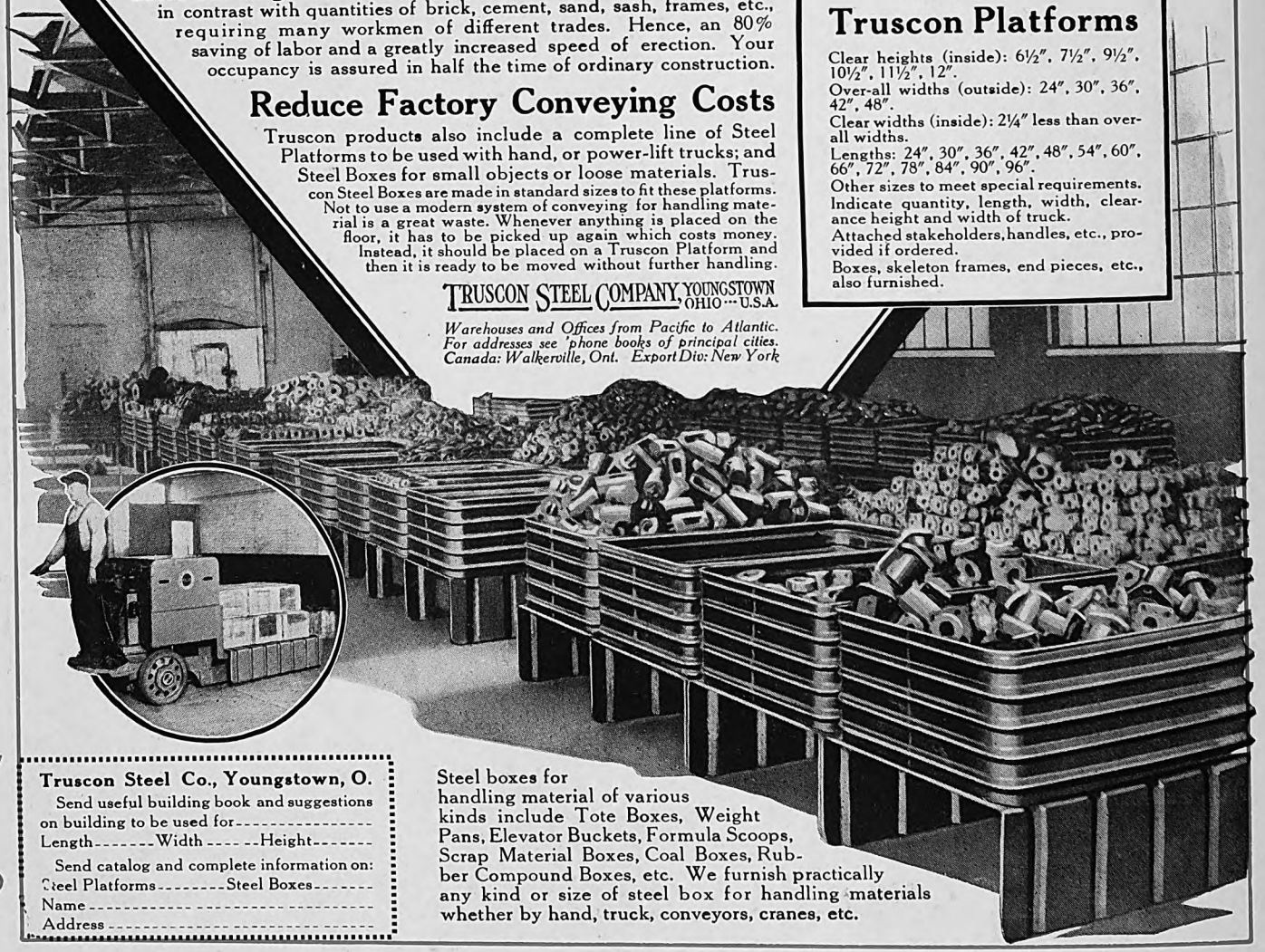
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Attached stakeholders, handles, etc., provided if ordered.
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TRUSCON STEEL COMPANY, YOUNGSTOWN OHIO ··· U.S.A.

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Send useful building book and suggestions on building to be used for_____
Length_____Width_____Height_____

Send catalog and complete information on:
Steel Platforms_____Steel Boxes_____
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Address_____

Steel boxes for handling material of various kinds include Tote Boxes, Weight Pans, Elevator Buckets, Formula Scoops, Scrap Material Boxes, Coal Boxes, Rubber Compound Boxes, etc. We furnish practically any kind or size of steel box for handling materials whether by hand, truck, conveyors, cranes, etc.

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Industry Illustrated

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On page 80 will be found a list of those concerns to whose courtesy we are indebted for photographs in this issue not otherwise credited.

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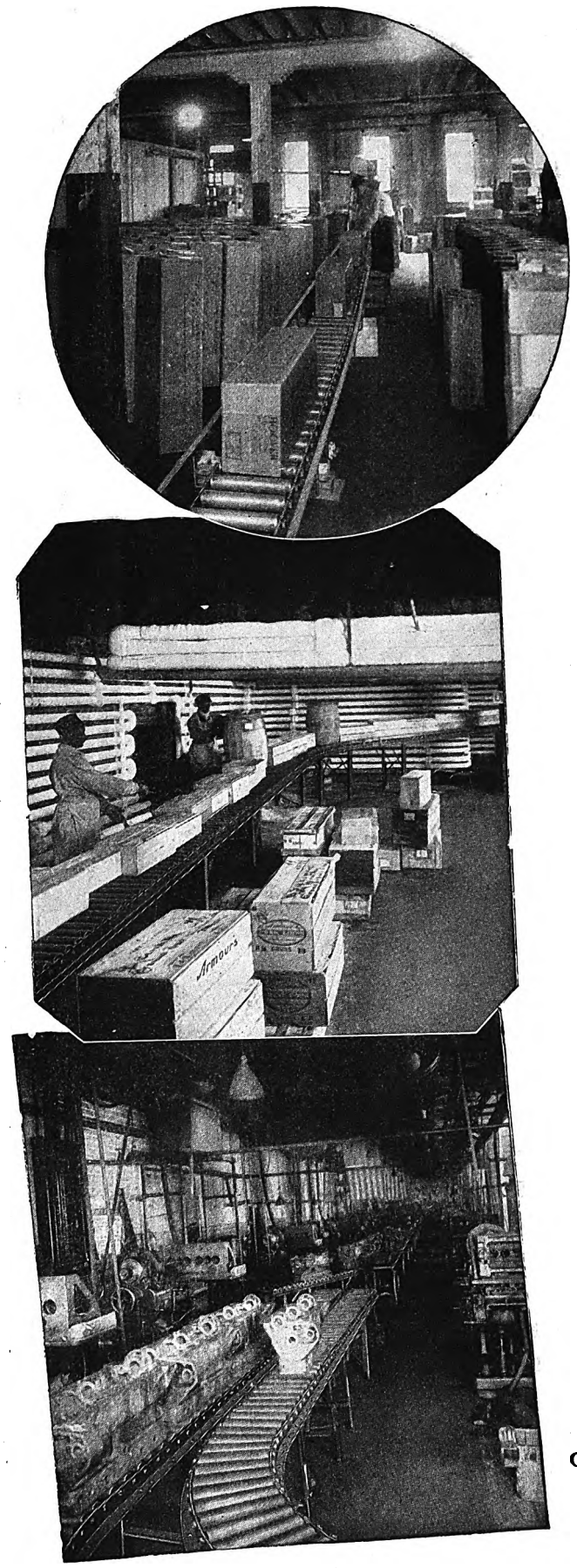
JOHN R. DUNLAP, JR., *Secretary*

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For Every Load
There is a
STANDARD

Gravity Roller Conveyor that will carry it easily, effectively and economically.

Glance at the pictures on this page and you will confirm the truth of the statement that there is a Standard Gravity Roller Conveyor for every load.

The picture at the top of the page gives you an idea of the *distance* that gravity roller conveyors are carrying cartons of material at the Hoover Suction Sweeper Company's Plant, North Canton, Ohio. The center illustrates the *variety* of packed merchandise that is conveyed by means of *Gravity* at the Armour and Company's Plant, Chicago, Illinois. The bottom view is a typical installation of Standard Roller Conveyors in a Machine Shop, Foundry or Automobile Plant. This particular picture was taken at the plant of the Continental Motors Company, Detroit, Michigan.

It is the aim of the Standard Conveyor Company to serve industries conscientiously. To do that, a part of Standard Service is advisory. If you are interested in lower handling costs, send for Catalog "S."

Our engineering service and suggestions to you are given without obligating you in any way.

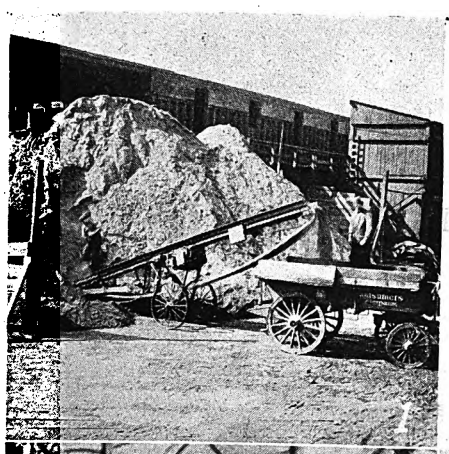
STANDARD CONVEYOR COMPANY.

General Office and Plant, North St. Paul, Minn.

"Brown-Portable" Products Plant, North Chicago, Illinois

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1—U-Type Barber-Greene reclaiming coal from storage into wagons.

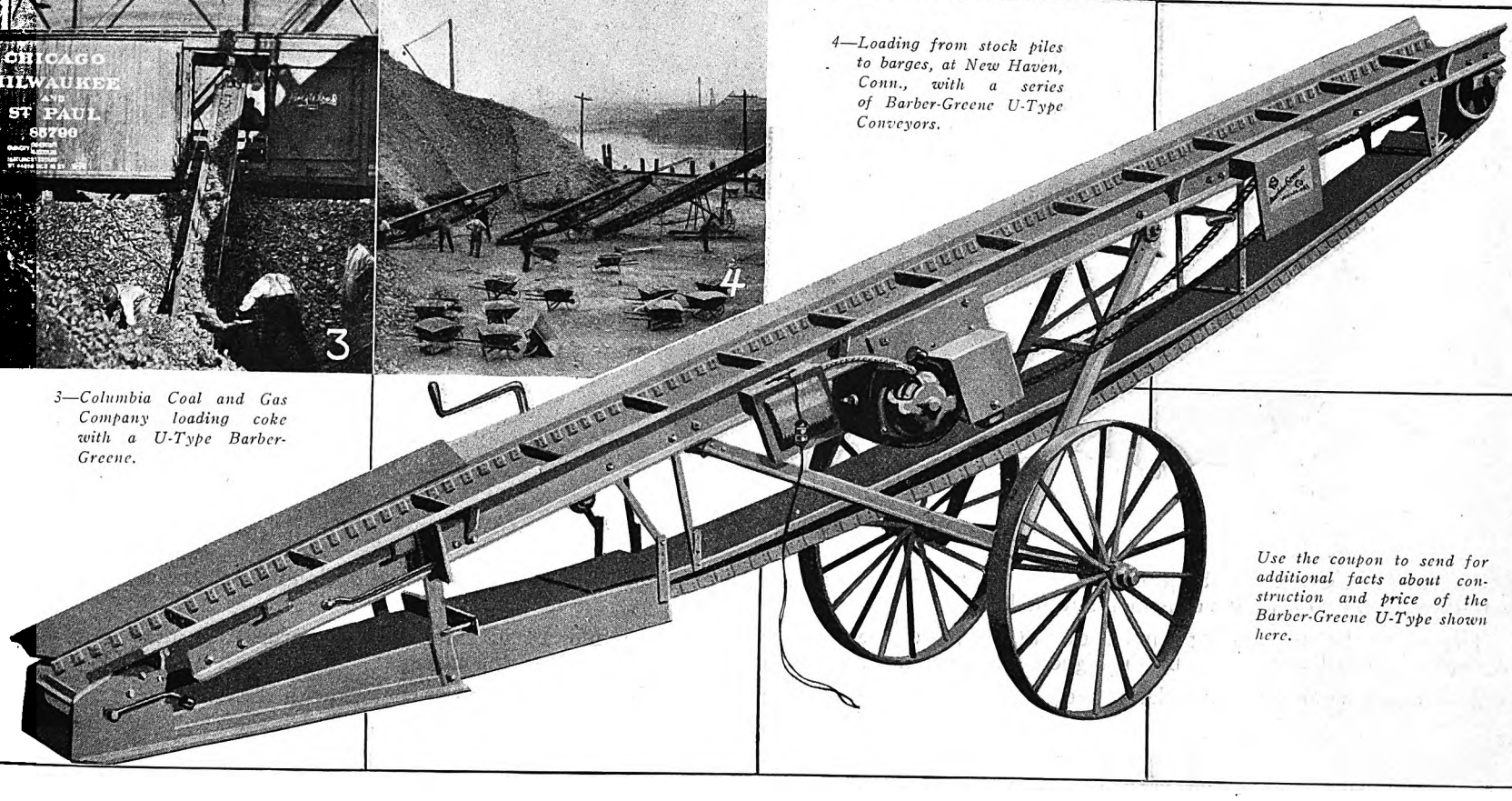


2—Peter De Lass and Sons unloading 100 tons of coal in one day direct from car to truck with two men.



3—Columbia Coal and Gas Company loading coke with a U-Type Barber-Greene.

4—Loading from stock piles to barges, at New Haven, Conn., with a series of Barber-Greene U-Type Conveyors.



Use the coupon to send for additional facts about construction and price of the Barber-Greene U-Type shown here.

Lower Your Coal-Handling Costs

U-Type Barber-Greenes Reduced to $350

With the well-known saving and profit effected by handling coal with Barber-Greenes we can now offer an additional advantage.

Because the price of the U-Type Barber-Greene Conveyor has been reduced to $350 you can now avail yourself of many Barber-Greene advantages at a very small investment.

This conveyor generally displaces from two to ten men, depending on the nature of the work. As a rule it handles about 26 tons of coke per hour, 90 tons of gravel, and 44 tons of coal. The amount handled depends considerably on conditions and may be less or more than these average figures.

The conveyor is a one-man machine for universal use. It is 22 feet long and has a belt of special patented construction with steel flights every 18 inches. These enable the conveyor to handle material at exceptionally steep angles.

There is a crank operating a self-locking winch, for elevating the discharge end to any desired height up to 35 degrees.

Skirt boards run the full length of the belt, are six inches deep and enable the conveyor to handle large lumps.

Making this conveyor in one width and length has enabled us to offer it at the unusually low base price of $350.

Since this price was announced a month ago sales have tripled as against the already large volume for the same period last year.

Send the coupon for our new prices on electric and gas equipment for this conveyor.

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Without obligation to me, please send me a Catalog of the Type-U Barber-Greene.

What is the new reduced price on the U-Type Barber-Greene Conveyor equipped with (check equipment desired).

☐ 3 phase, 60 cycle, 220 volt motor;
☐ With a motor such as I have described on the back of this coupon;
☐ With Fuller and Johnson gas engine.

Name .....

Street .....

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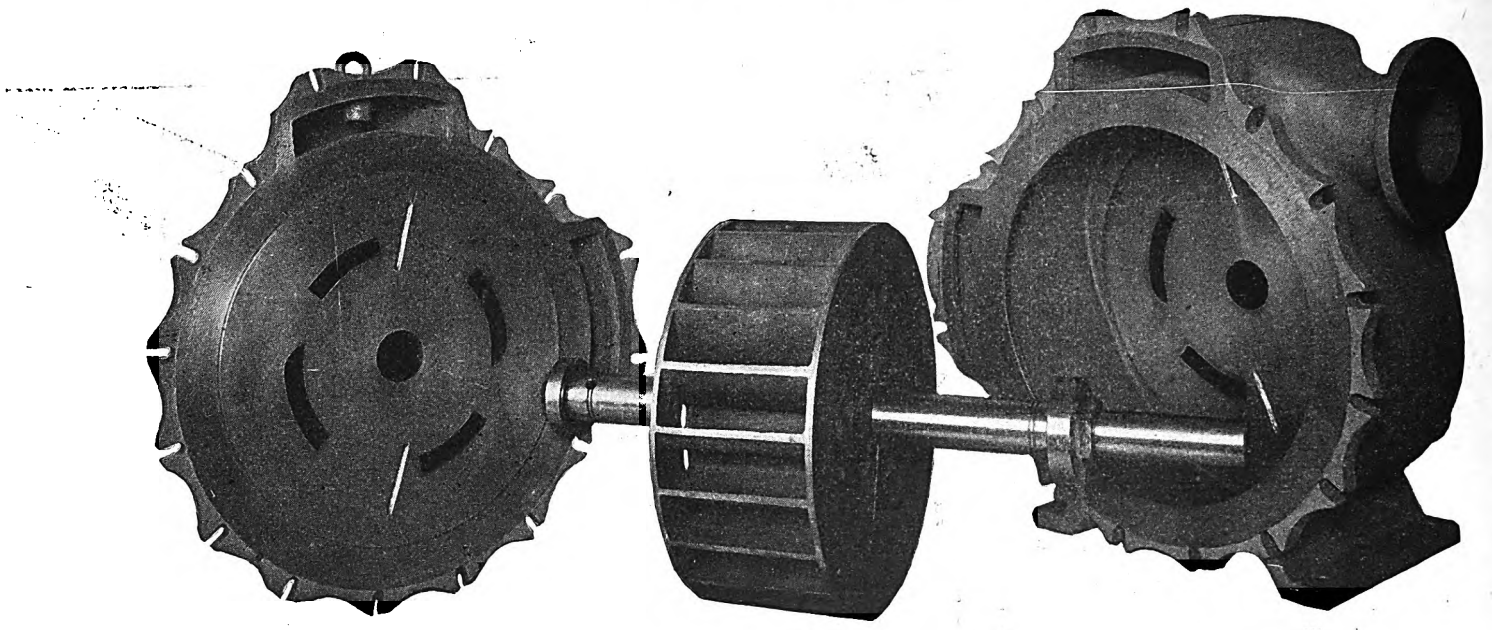
BARBER GREENE

Portable Belt Conveyors — Self Feeding Bucket Loaders

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THE ECONOMICAL AIR COMPRESSOR AND VACUUM PUMP



ALL THE PARTS OF THE HYTOR

THE HYTOR COMPRESSOR is valveless, has no gears, loose moving or reciprocating parts, no piston packing to renew, no cylinders to lubricate, and no bearing adjustments to make.

The rotor, the only moving part, is cast in one piece, the blades being rigidly reinforced by shrouds. The rotor is mounted on a short, stiff shaft supported at each end by the highest grade annular ball bearings mounted outside of the casing.

As the peripheral clearance is large, there is no possibility of the ends of the rotor blades coming in contact with the casing.

The original high efficiency is maintained indefinitely in continuous service.

The air is thoroughly washed during compression and contains no oil.

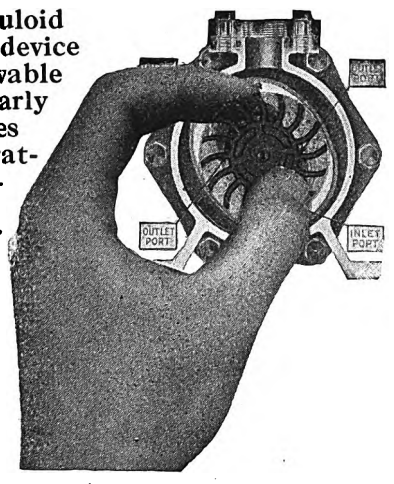
Hytor compressors occupy very much less floor space and are much lighter in weight than reciprocating compressors.

They run without vibration.

The cost of installation is greatly reduced as no expensive foundations are necessary.

No expert attendance is required as there are no adjustments to make. The cost of upkeep is negligible.

Hytor compressors are quiet in operation.

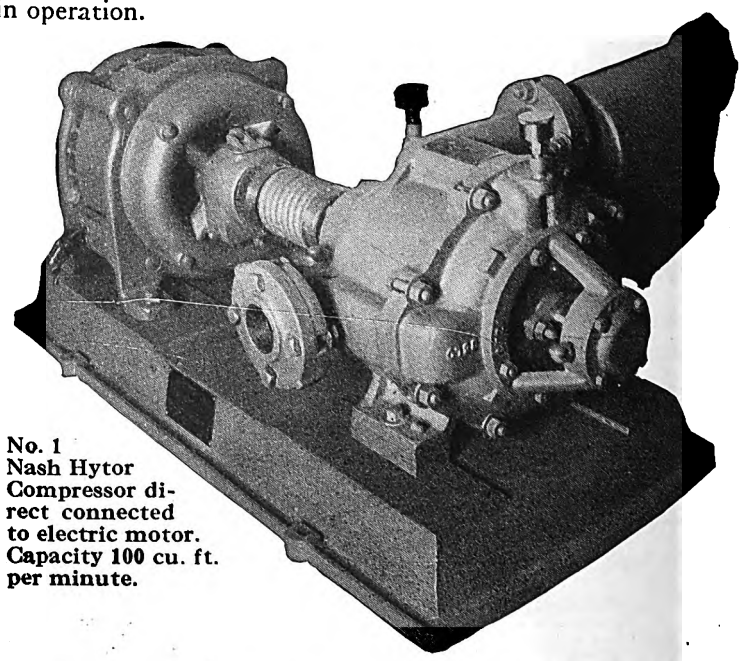


This celluloid graphic device with movable rotor clearly illustrates the operating principle. Send for your copy.

At pressures up to and including 15 lbs. per square inch, and vacuums up to 20 inches of mercury, the Nash Hytor affords the simplest and most economical means for handling air or gas, for all of the usual purposes where air under pressure is required, and they can be used on many special services for which the ordinary compressor is not adapted.

It is common practice in handling mildly acid vapors to re-circulate thru the pump an alkaline solution for the protection of the cast iron structure of the pump. In handling chlorine gas, concentrated sulphuric acid is re-circulated.

Air handled by the Hytor is delivered absolutely clean and free from dust or oil; a great advantage in the agitation of good products or in absorption processes where diffusion of air is accomplished by blowing thru filters, porous blankets or small orifices.



No. 1 Nash Hytor Compressor direct connected to electric motor. Capacity 100 cu. ft. per minute.

6

NASH ENGINEERING CO.

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Industry Illustrated

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EDITORIAL

What About Maintenance?

THERE is a story about a certain newly elected railroad president, who, wanting to stimulate loyalty among the rank and file, decided to reward those employees who had seen the longest service with the road. The records disclosed that an individual, whom we may call John, had been with the company for some forty years. He was sent for, and after congratulations, the new chief asked him what his duties were. "John" explained that he was one of the men who, when a train pulled in, tapped the axles and wheel flanges with his little hammer.

"Well, John," said the other, "I'm more familiar with the financial side of railroading; and, just between you and me, I've always wondered what you fellows do that for, but was ashamed to ask. Why *do* you tap 'em that way?"

"Gosh," said John, "I dunno what for; all I know is, that's me job."

Now that is supposed to have happened quite a few years ago—and it is only fair to assume that today, none of us is quite so abysmally ignorant with regard to maintenance. Nevertheless, it is safe to say that at least three-fifths of our industrial plants are suffering heavy financial losses resulting from *neglect* of maintenance.

We know that wood is subject to decay; and proper painting safeguards it. We know that iron and steel are subject to rust; and paint or oil, or a coating of some impervious metal protects it from rust. We know that windows become dirty and thus cut down the natural light, affecting production and increasing the cost for artificial light. We know that a leaky valve or joint in steam or air lines is a steady, continuous drain in actual dollars and cents. We know that it costs less to inspect and repair a roof today, than to let it reach a point requiring entire replacement next year. We know that a belt which is allowed to run without inspection and periodic repair, is very likely to cause damage, as well as a shutdown of production, when it does let go. We know that neglect of oiling, in the long run, is a hundred-fold more costly than the most expensive lubricating system.

All these things—and many more—we know. But, either through a sense of false economy, or through mere procrastination, two-thirds of the industrial plants of the country have so far failed to put that knowledge into practice; and, in these plants, more than one-half the potential profit is thereby going to waste.

It is one thing to describe a condition, and quite another to set about remedying that condition. With that in mind, we have arranged for a series of articles—the first of which begins on page 8 of this issue—designed not merely to tell of the various important factors of maintenance, but to show how they should be handled.

In this, and succeeding issues of INDUSTRY ILLUSTRATED, we plan to show the executive, the maintenance man, the engineer, and the man on the job, how to get the utmost in service from his plant and equipment, how to hold down depreciation and minimize breakdowns—in short, how to recover that half of the realizable profits that is now being lost.

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The Industrial

What Maintenance Means to Pro

BY WILLIAM



Fig. 1. When this parapet wall was blown over during a wind storm, it broke the joists and roof boards, but the roofing made up of many layers of roll roofing, firmly cemented together, held together and protected the storage room beneath.

Fig. 2. A prepared asphalt roof on one of the buildings of a large tractor plant.

THE subject of plant maintenance has not received the attention it should have received in the past, due to the fact that the average manufacturing executive has not linked up maintenance with production. However, they are inseparable and the keen executive who is looking forward to lowering costs as a prerequisite to increased sales will do well to give the problem of maintenance its due share of attention. We all know that we cannot get the orders out on time if we have breakdowns in important units just when we need them most. However, a great many of us take these breakdowns as a necessary part of the production game and don't really make a serious effort to overcome them. If the product is to flow out of the shipping room door day after day without interruption, a well planned maintenance department is as necessary as a well planned production department. How much better it is to pay each week a certain amount to a maintenance crew to take care of small repairs as they are needed than to pay out large

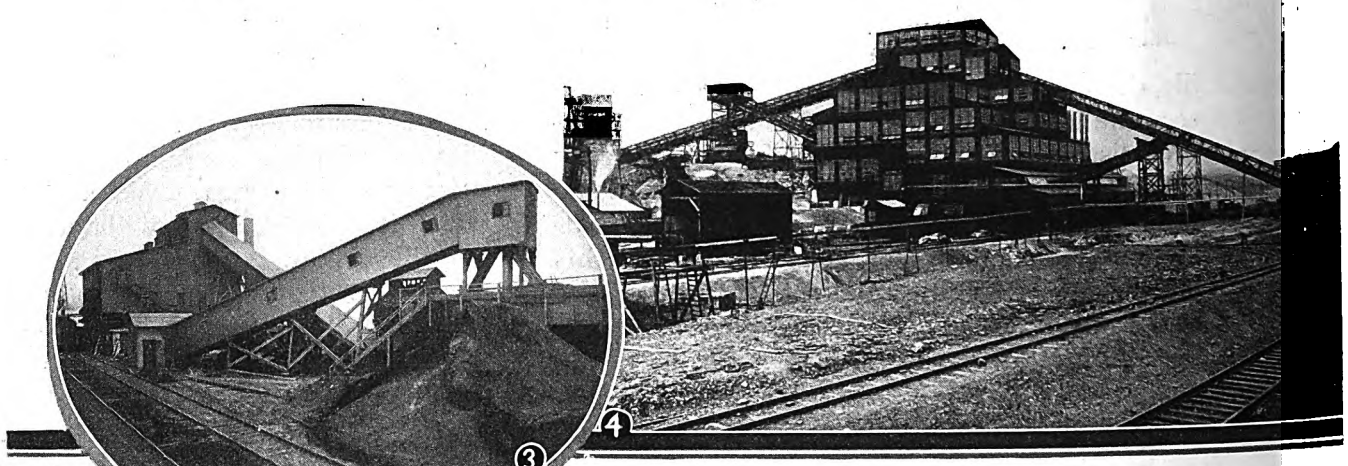


Fig. 4. Here is another case where metal, protected with asbestos, protects the roof of one of the largest coal breakers from sulphurous acid fumes.

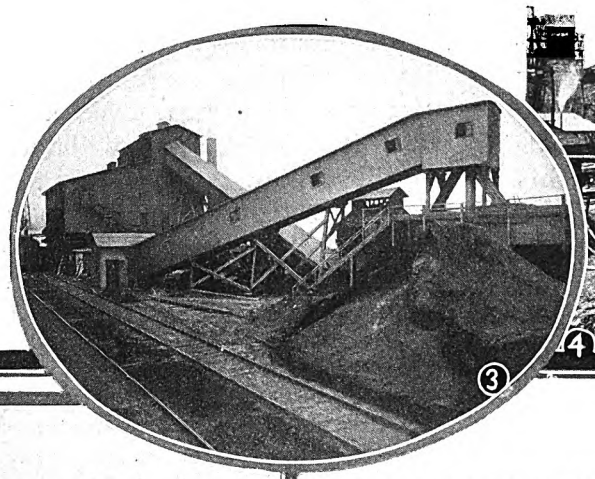


Fig. 3. Moisture and acid fumes at the above plant dictated a choice of asbestos-protected metal roofing.

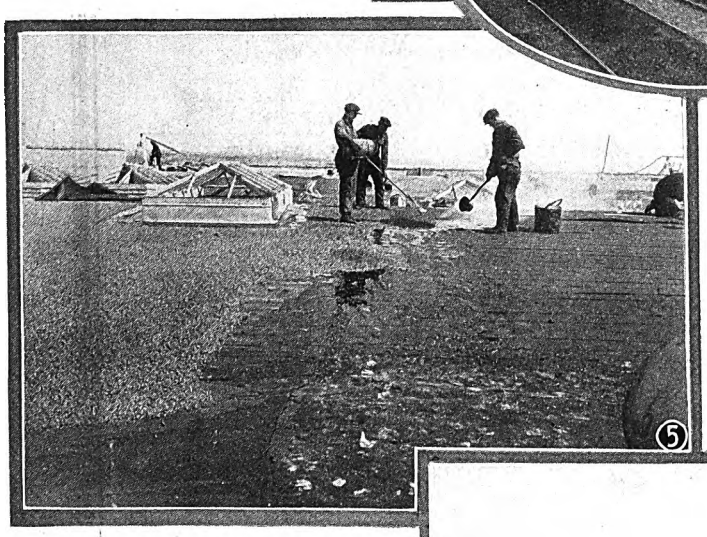


Fig. 5. Applying tar and gravel over roofing paper on a flat roof area.

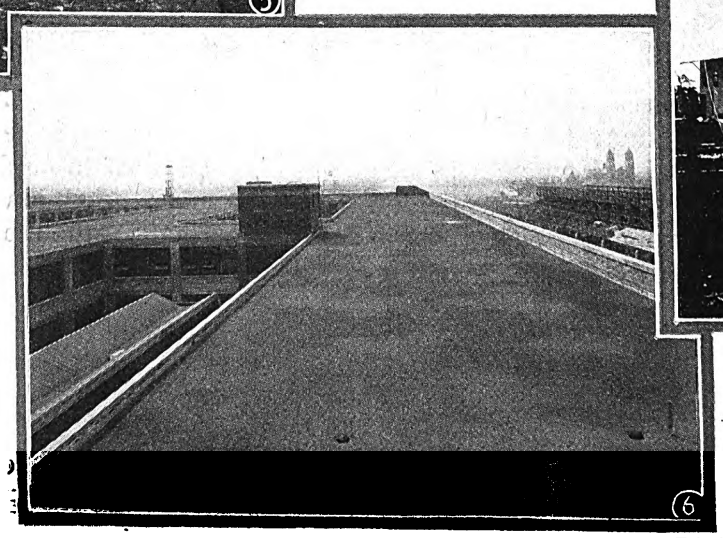


Fig. 6. The finished tar and gravel roof, construction of which is shown in Fig. 5.



Fig. 7. In the tropics, the heat-resisting properties of asbestos, and its immunity to insects and to the ravages of a tropical climate make this type of roof particularly applicable; though its use is by no means confined to the tropics.

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"Daily Dozen"

duction and to the Balance Sheet

G. ZIEGLER

amounts every once in a while for night and Sunday work on big repair jobs. It's the old story of "A stitch in time saves nine" in maintenance work. Get on the safe side and get breakdown insurance protection with a well organized maintenance department. Naturally, the method of handling this work varies with the size of the plant. The small plant can get along with a Master Mechanic or jack-of-all-trades who can repair anything from a belt to a building, while in the largest plants the number of men in the maintenance crews runs into the thousands. However, if the efforts of these men are well directed, the expense will pay dividends in increased and bettered production and in conservation of assets in the shape of buildings and equipment.

The primary object of maintenance work is to prevent trouble by making repairs before a break actually occurs.

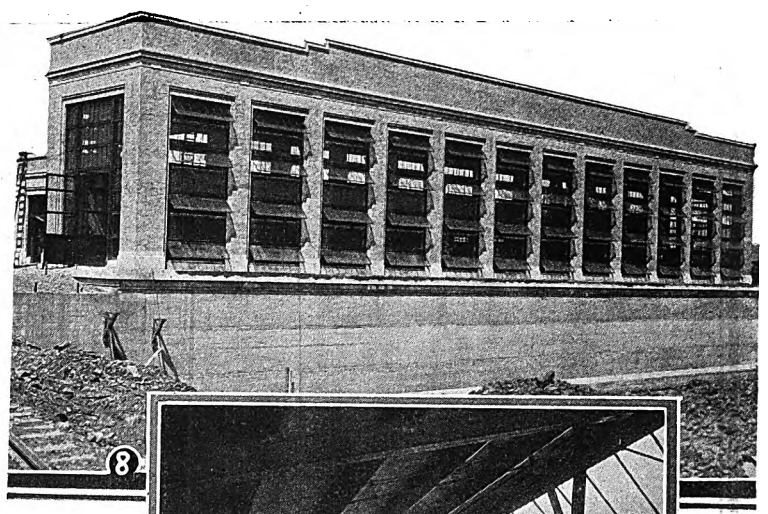


Fig. 8. The modern power house is becoming a thing of beauty as well as of utility, with maximum daylight and ventilation.

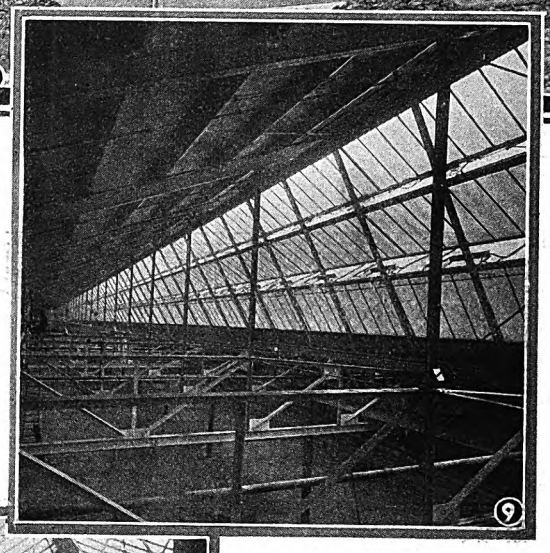


Fig. 9. Natural illumination and ventilation through the use of modern steel sash at the Ford Motor Company plant in Canada.



Fig. 11. This shoe factory makes use of daylight by means of modern steel sash and light-reflecting paint, at the same time admitting plenty of fresh air from outside. Note also the ventilating ducts on the ceiling.



Fig. 10. So long as these skylight windows are kept clean, lighting bills are minimized and production keeps up to schedule.

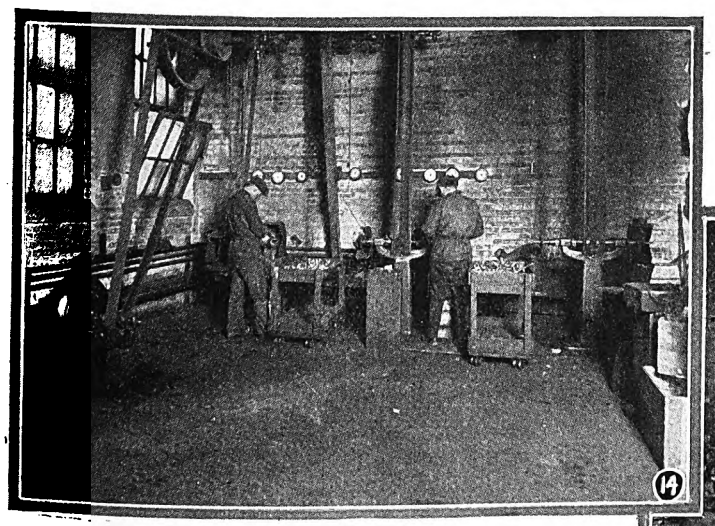


Fig. 14. At the extreme left is an exhaust fan which connects with the large pipe running along the wall to the exhaust hoods over the buffing wheels. Constant inspection of such a system pays, both in avoiding shutdowns and in lower power bills. White paint on the wall would materially help the lighting.

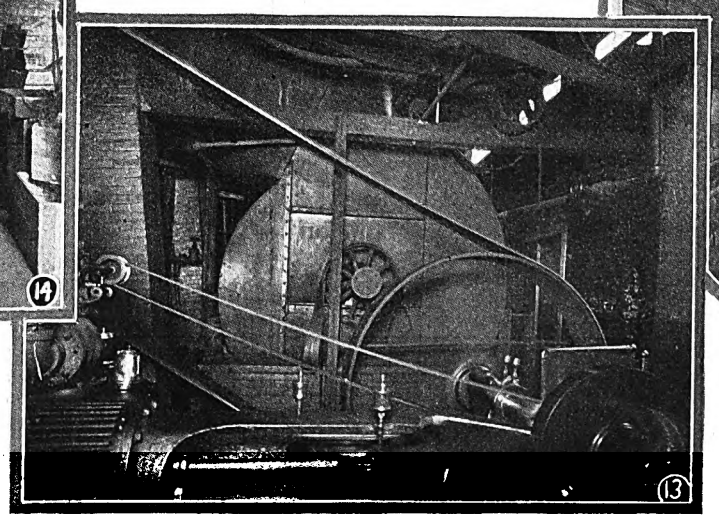


Fig. 13. The large fan in the background below is used for heating the paper room of a large paper mill.

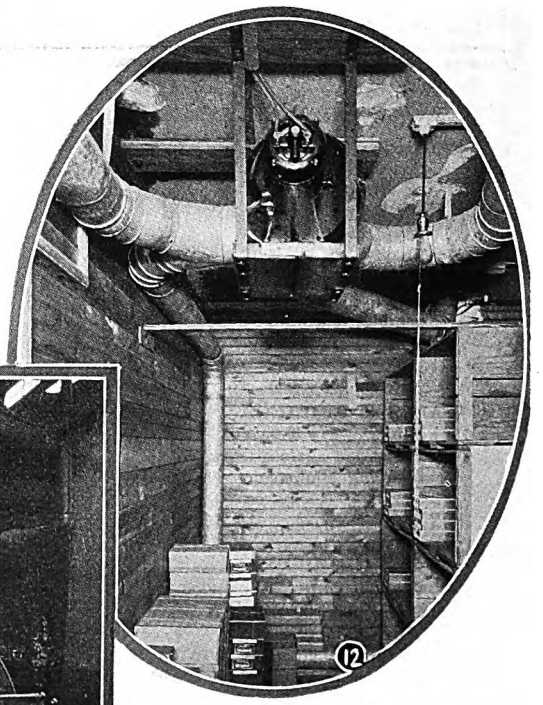
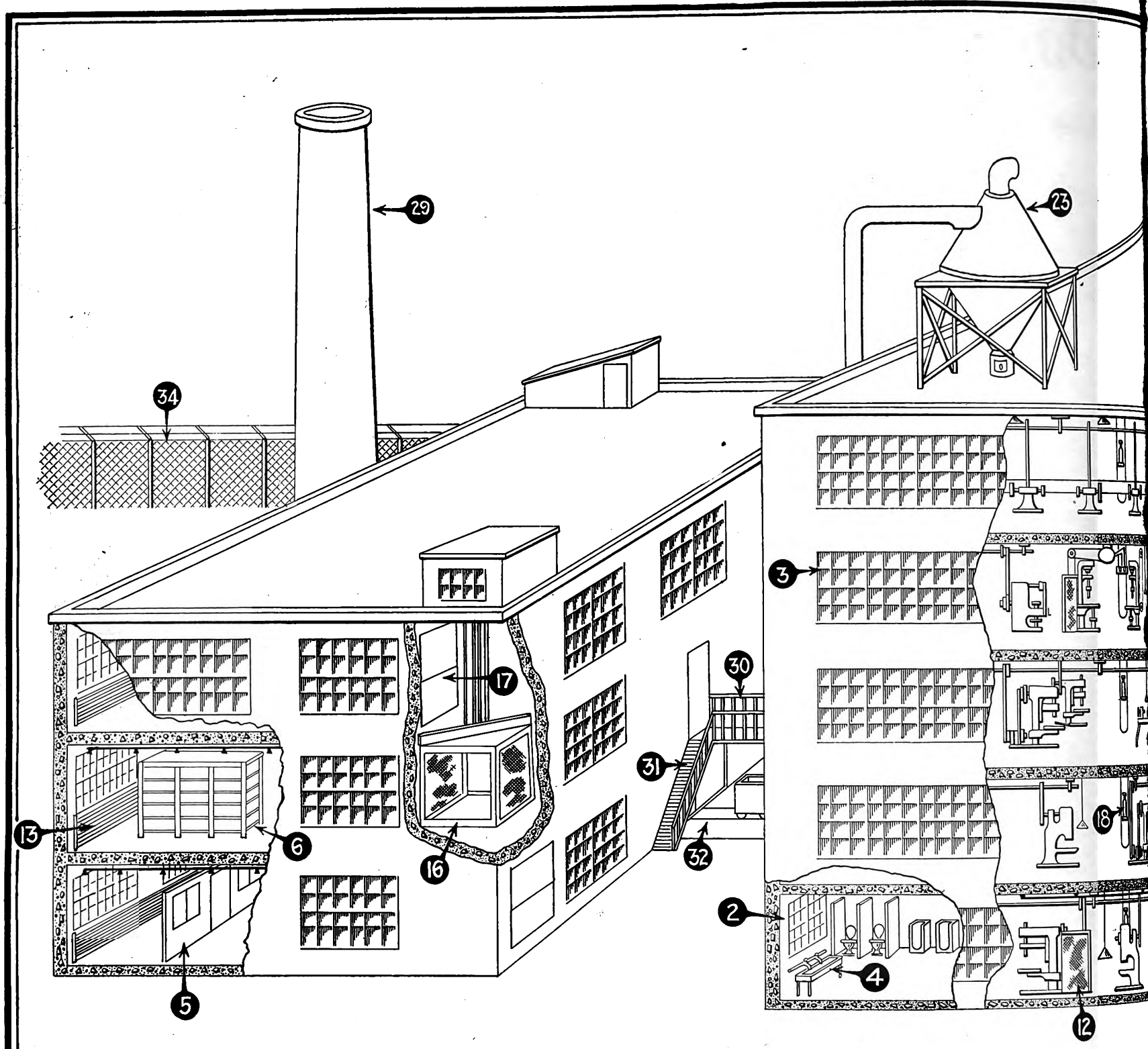


Fig. 12. This ventilating set supplies cold air to a storeroom for boxed candies.

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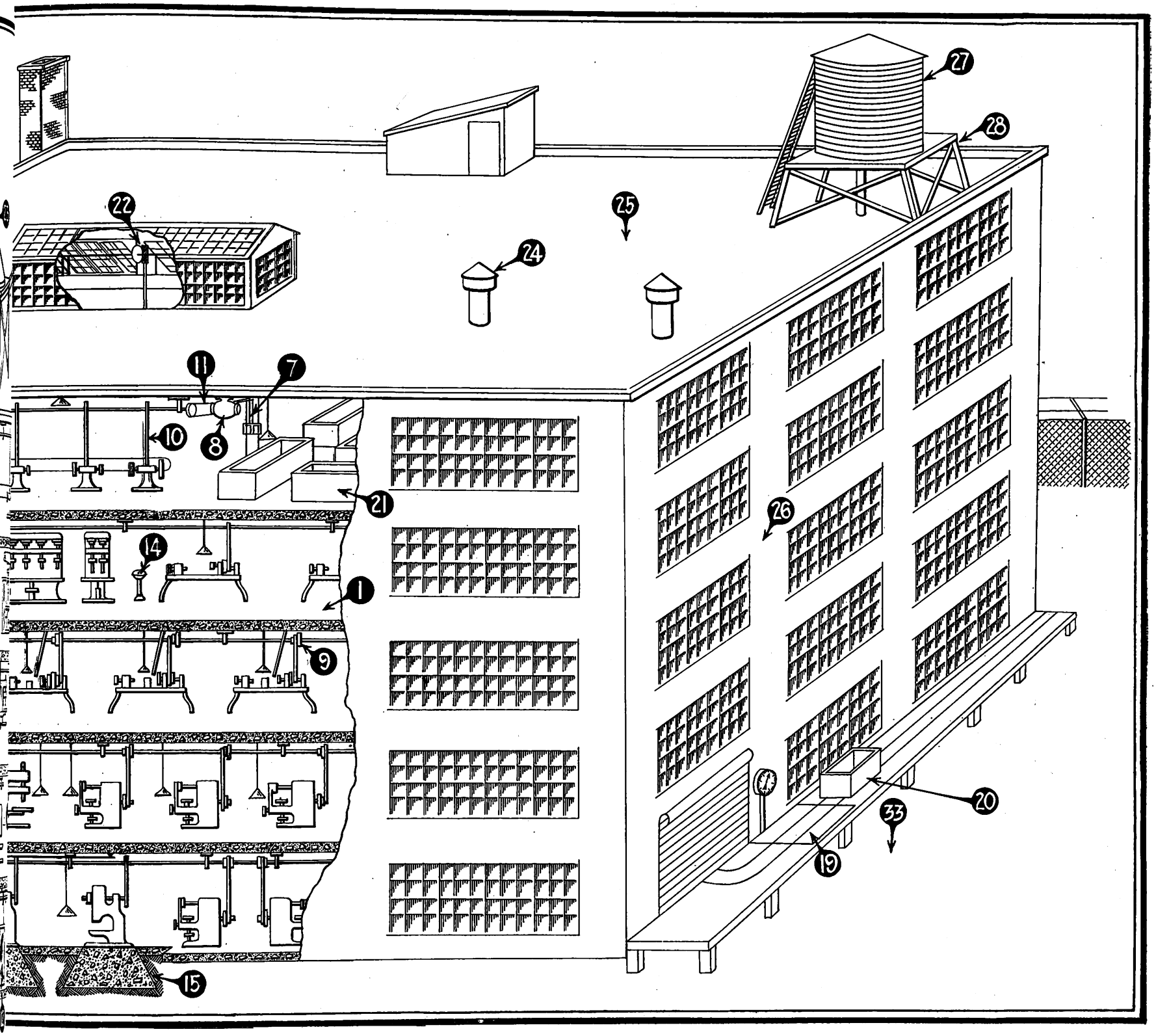
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  - Gauges
- Sprinkler
  - Pipe, cast iron, underground, steel or wrought iron
  - Fittings
  - Valves

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Dozen"

PIPING (continued)
Sprinkler
Hose reels & racks
Gauges
Pressure tanks
Water pumps
Air compressors
Water, Gas, Oil and Air
Pipe, cast iron, underground, steel or wrought iron
Fittings
Valves
Gauges
Meters

14 BUBBLERS OR DRINKING FOUNTAINS.
Wall type
Floor type

15 MACHINE FOUNDATIONS.
Concrete
Steel beams
Wood on end
Piles
Wood
Concrete

16 ELEVATORS.
Freight
Passenger
Electric control
Cables
Safety devices
Cable locks

17 FIRE DOORS.
Vertical rising & lowering
Sliding
Rolling

18 FIRE EXTINGUISHERS.
Hand
Wheel types

19 PLATFORM SCALES.

20 INDUSTRIAL TRACK & EQUIPMENT.
Track
Switches
Cars

21 PLATING ROOM.
Tanks
Wood
Lead lined
Composition floors
Low voltage generator
Copper bus bars
Voltmeters & ammeters
Anodes

22 MONITORS.
Swing Sash
Sash operating devices

23 VENTILATING & EXHAUST SYSTEMS.
Fans
Piping
Hoods
Dust Collectors

24 VENTILATORS.

25 ROOFING.
Tar & gravel types
Tin
Slate
Gutters
Downspouts

26 EXTERIOR OF BUILDINGS.
Paint on steel & concrete & wood

27 TANKS.
Sprinkler
Steel
Wood
Heating coils
Pipe covering

28 STRUCTURAL STEEL.

29 STACKS & CHIMNEYS.
Concrete
Brick
Steel

30 BRIDGES.
Steel beams.
Steel trusses
Wooden deck
Corrugated iron covering

31 FIRE ESCAPES.

32 WALKS.
Concrete
Wood

33 ROADS.
Paving.
Crushed stone
Brick
Wood block
Concrete

34 FENCES.
Wire
Board
Picket
Iron

35 SPRINKLER SYSTEM

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cian, Pipefitter and Plumber, Tinsmith, Machine Repair, Carpenter and Mason, Painter, and Sanitation Departments.

The maintenance of the plant itself is practically the same as housekeeping. Floors are to be vacuum cleaned or swept and scrubbed, windows are to be washed, washrooms and toilet rooms must be cleaned and kept supplied with soap, etc. This is a housekeeping job, no more, no less, but in a big plant it's a man sized job to do it well. And cleanliness pays too. There is no question that a man can do more work and better work in a clean, well lighted and well ventilated plant than he can in a dirty, dark and stuffy plant. And as every square foot of floor space costs money it is good business to get as much production as is possible out of every man.

All kinds of flooring will wear out in time, but when repairs are necessary, it is well to study conditions so as to put in the floor best suited to the particular service. There is no one best kind of floor, each has its merits. A floor designed for heavy trucking is not necessary in a light assembling room and vice versa, a floor suitable for light assembling may not be good where heavy trucking is done. Some men who stand on their feet at a machine all day long complain about a concrete floor, especially if it is laid directly on the ground. The writer has overcome this in some cases by making gratings about two feet by four feet at machine for the men to stand on. These can be easily moved when cleaning the floor. As fireproof concrete buildings are coming more and more into use, the men are getting accustomed to concrete floors and

(*Continued on page* 64)

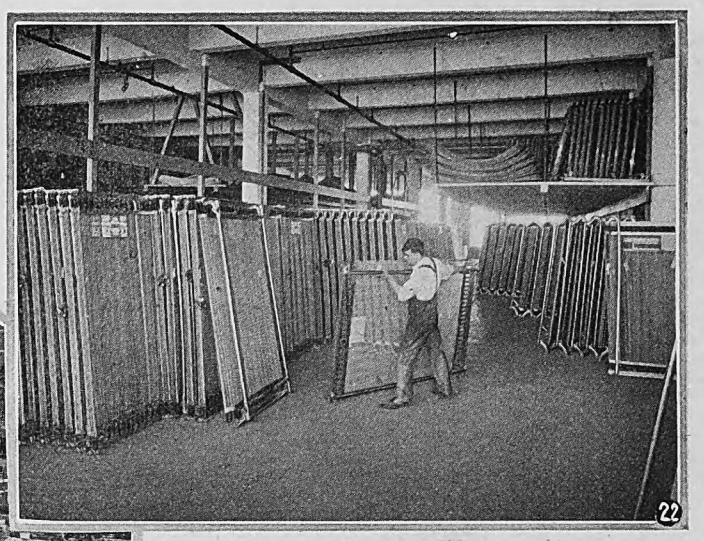
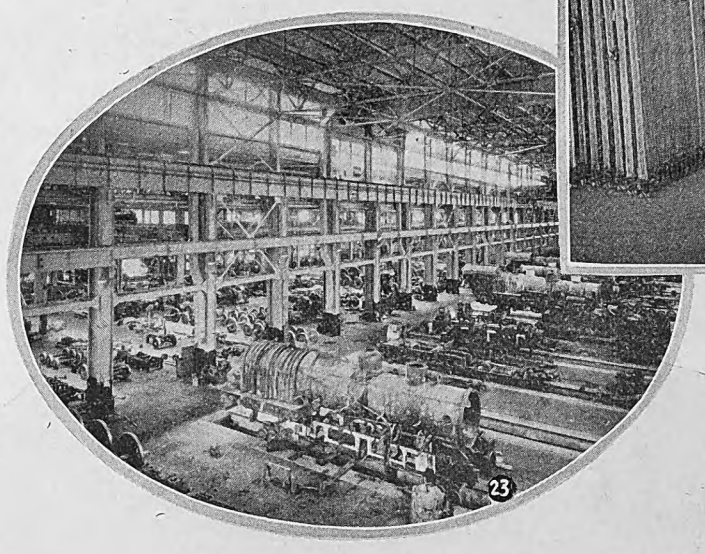


Fig. 22. The ordinary concrete floor would never stand up under such service as this, but special treatment gives concrete a hard surface so that these steel bed-frames make no impression on it. Notice the sprinkler pipes, painted a different color than the ceiling.

Fig. 23. In the photograph below, we again find the wood block floor under conditions which are exceptionally severe on any type of floor. The center bays in a wide one-story building can be effectively daylighted by a high monitor, as shown.



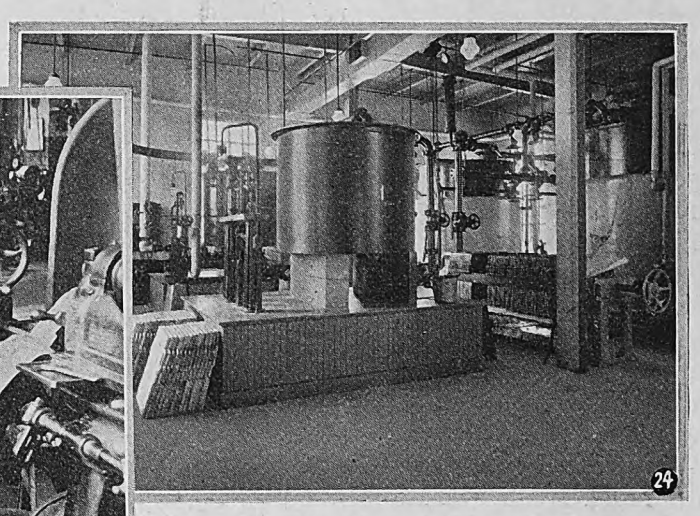


Fig. 24. The special composition floor in this case has to withstand the attack of chemicals—in the laboratories of the E. I. duPont de Nemours Company. Exposed piping, etc., in such cases can be protected by acid-resisting paint.

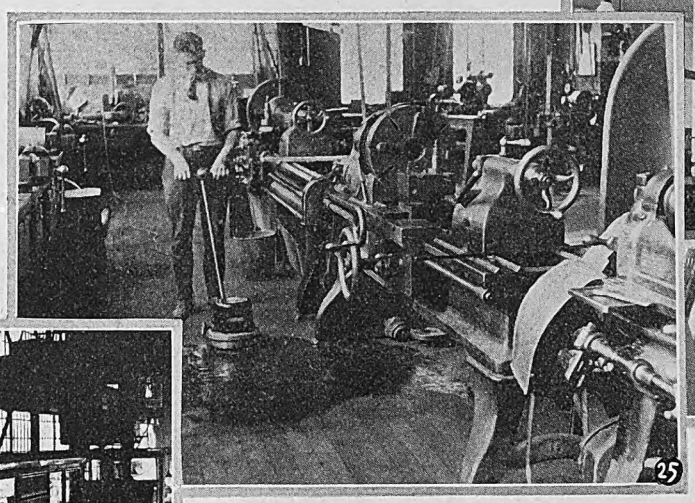


Fig. 25. Clean floors, nowadays, are within easy reach without the back-breaking work of scrubbing them by hand. A good motor-driven scrubber with a good cleaning compound makes short work of the job.

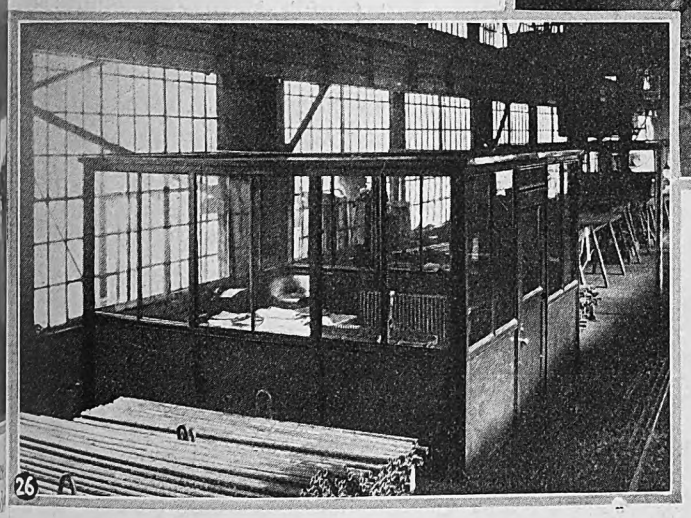


Fig. 26. A comfortable, well-lighted, steam heated office, without the necessity of heating an entire building. This is only one of the possible applications of modern partitions.

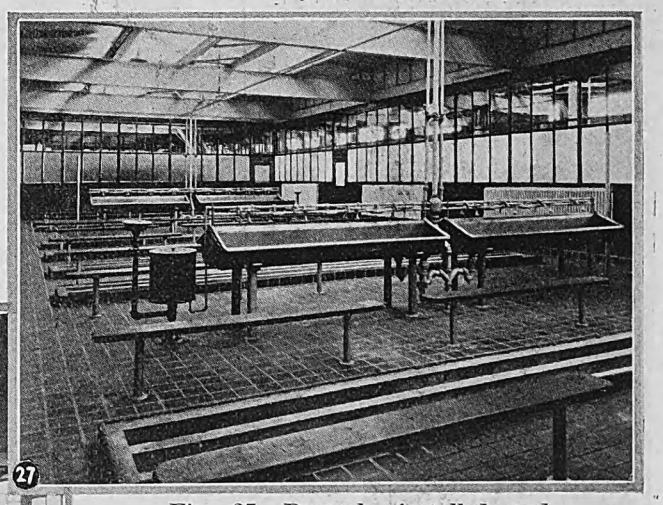


Fig. 27. Properly installed and maintained sanitary epuipment has come to be recognized as a highly important factor in production. The drinking fountain at the left has a compartment for ice.



Fig. 28. Here we have a wear-resisting composition floor, perfectly smooth; light-reflecting paint on the ceilings and walls; and a dark paint dado on the lower surfaces where finger marks would show.

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Watching the Pulse of the Power Plant

Not Merely Keeping it Running—but Keeping It from Running Down— Is the Problem

By James T. Beard, 2nd

WE are told that the Chinese pay their physicians for keeping them well. As soon as they get sick, the doctor's pay automatically stops. Let that thought sink home and then ask yourself if, after all, the Chinaman is so many thousand years behind the rest of the world. Is he not in that respect a few steps ahead of some of his so-called more progressive neighbors?

Analyzing this relation between the Chinaman and his family doctor, just what is the physician's function in the eyes of his patient? What is his *raison d'etre?* Merely this; to keep him well, to make him better able to do his daily work, and to increase his days of usefulness as a producer.

We are not prepared to say how much truth is in this description of the Chinese attitude. But we do say that, if it is true, we who play with power plants in America may well look to the Far East for a worthy example.

An operating engineer, worthy of the name, stands in much the same relationship toward the power plant under his care as does the Chinese physician toward his patient. One of his duties is to run the plant. But the watch engineer can do that. Even the oiler could do it in a pinch.

If the chief is on to his job, his big duty is to keep that plant in a healthy condition. Not to be chasing around with a Stillson wrench in one hand and a large wad of waste in the other, with the beads of perspiration standing out on his grimy forehead, while he runs here and there, putting new valves in the feed pump, patching up this boiler or that engine and hoping that he can get through the day without a mishap.

Sometimes we find him doing these things, but they are not

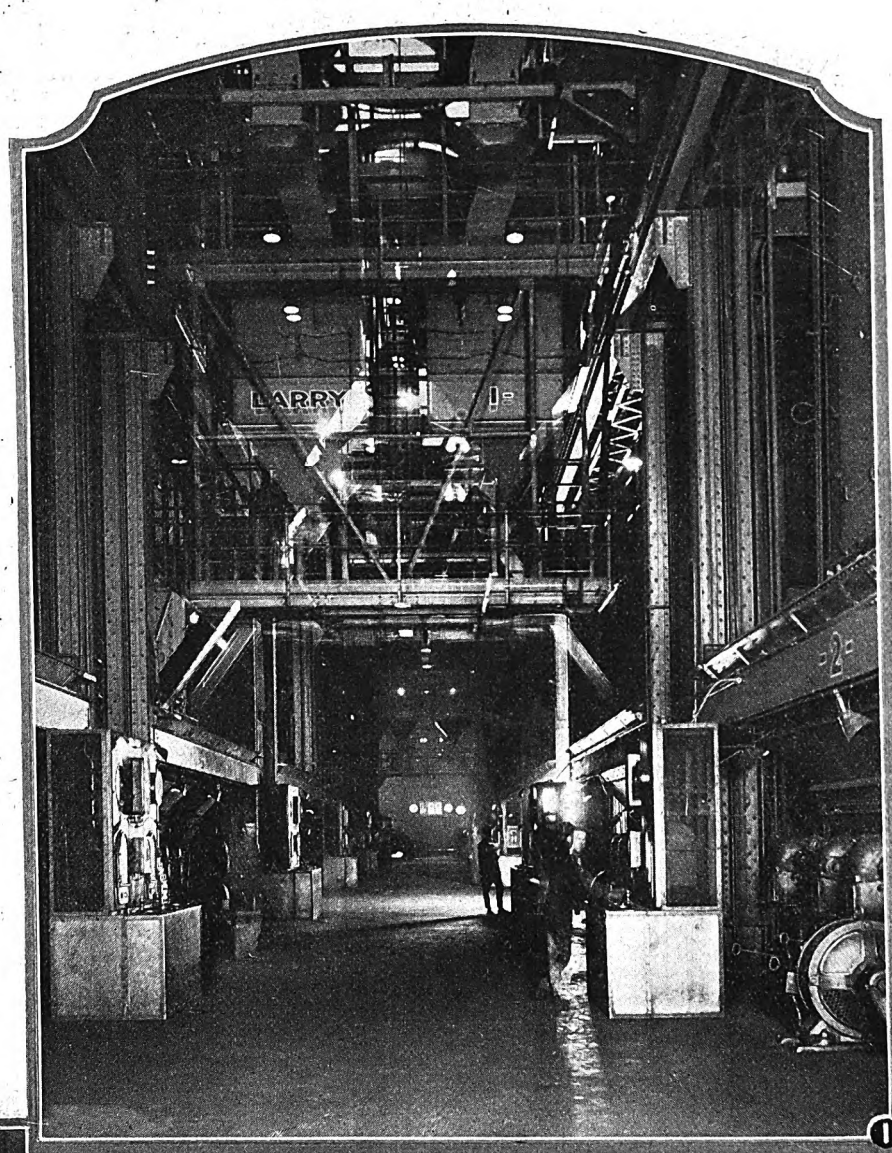


Fig. 1. Due to the severe service to which boiler house equipment is subject, maintenance becomes a vital factor in the operation of the plant. The life and safety of the boilers depends upon the inspection and care they receive, and the repair and operating costs of the auxiliary equipment is determined by the amount of attention that is given to it.

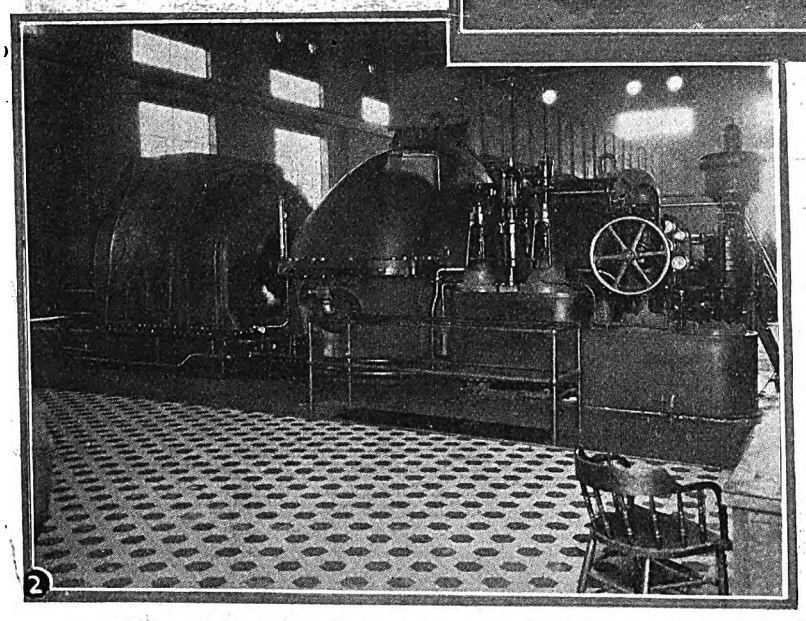


Fig. 2. Large turbo-generators are usually vital units in those plants where they are used. Any shutdown of such equipment seriously affects the entire pant. When they are propery inspected and a full supply of lubricating oil is assured to all parts, they are the smoothest runninp units in the plant.

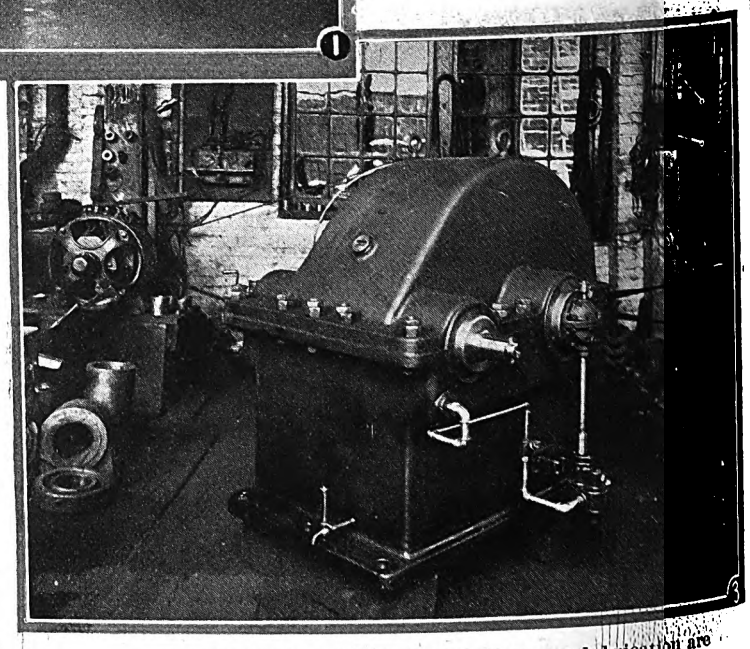


Fig. 3. Correct alignment and proper lubrication are vital factors in the smooth operation of reduction gear sets, whether they are used in connection with steam turbines or elsewhere. They should run with a minimum amount of noise, since noise means excessive wear and repair costs.

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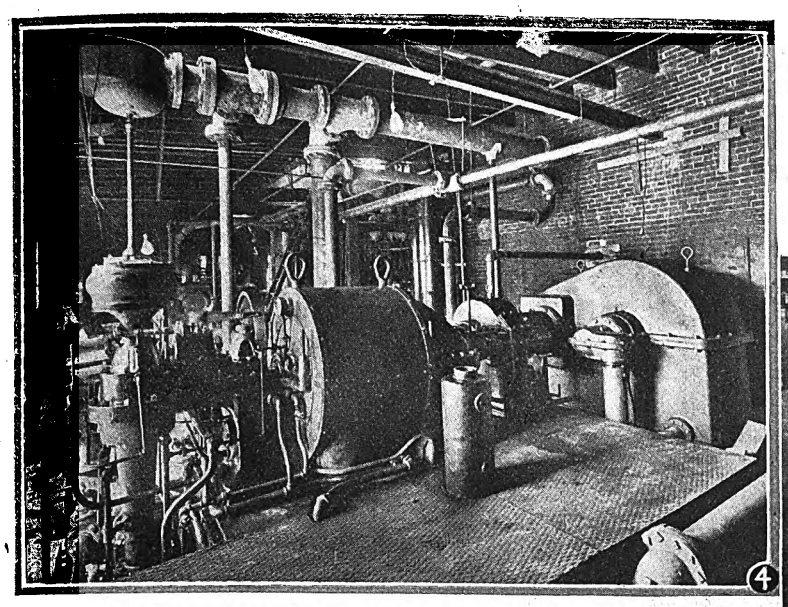


Fig. 4. Small turbine drives are frequently used in driving individual main units in the plant. The illustration shows a steam turbine connected to a beater engine in a paper mill. Naturally lubrication is the most important factor in the smooth operation of these units, but leaky packing glands cause unnecessary steam and power losses and result in a "messy" floor.

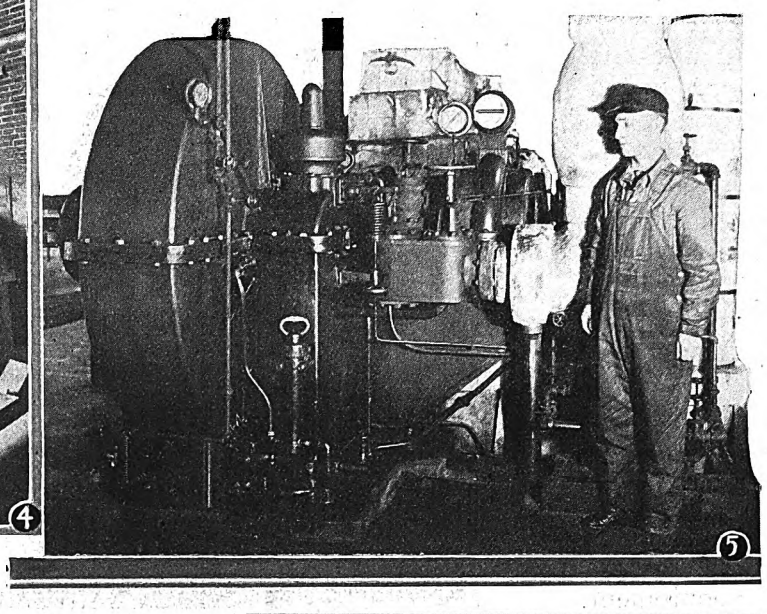


Fig. 5. The gages of a steam turbine are warning signals and should be carefully watched by the operator. The instant an unusual condition is indicated, the cause should be hunted down. Neglect may result in expensive repairs and shut-down of the unit.

his job. We like to think of him as our "prevention expert," the man who keeps trouble out of the plant, the man who anticipates weakness in his equipment and forestalls breakdowns and expensive repairs. In short, he is the man who spells maintenance with a capital "M"; he believes in it and he practices it. He knows that, even through his cost records show small increases for maintenance, these increases are like so much insurance against expensive repairs later and a possible shutdown of the mill.

Maintenance is *prevention;* repairs are *medicine.* And we never did like medicine. The purpose of power plant maintenance is to maintain a high standard of operating economy, to insure dependable and reliable service of the equipment, and to prolong the life of the machinery investment. Repairs are the result of accident, inadequate or unintelligent maintenance, or unsuitable operating conditions or equipment. At best they are mighty poor substitutes for proper maintenance.

Take the case of your automobile, for example. Your instruction book gives you a chart, telling where and when to oil the various parts and how much oil to put in. It's a mean job at best and is frequently neglected. The result is a gradual wear and tear on the engine, the transmission or in the differential, carbon deposits on the piston and behind the rings, broken rings or

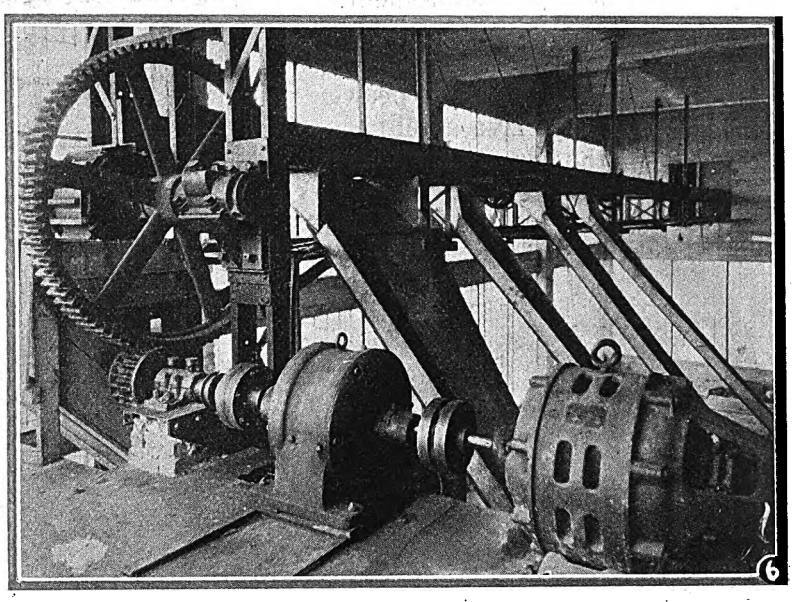


Fig. 6. Coal conveyor drives are usualy located in an out-of-the-way place. As a result, they may often be neglected until the conveyor is shut down. Regular inspection is vital.

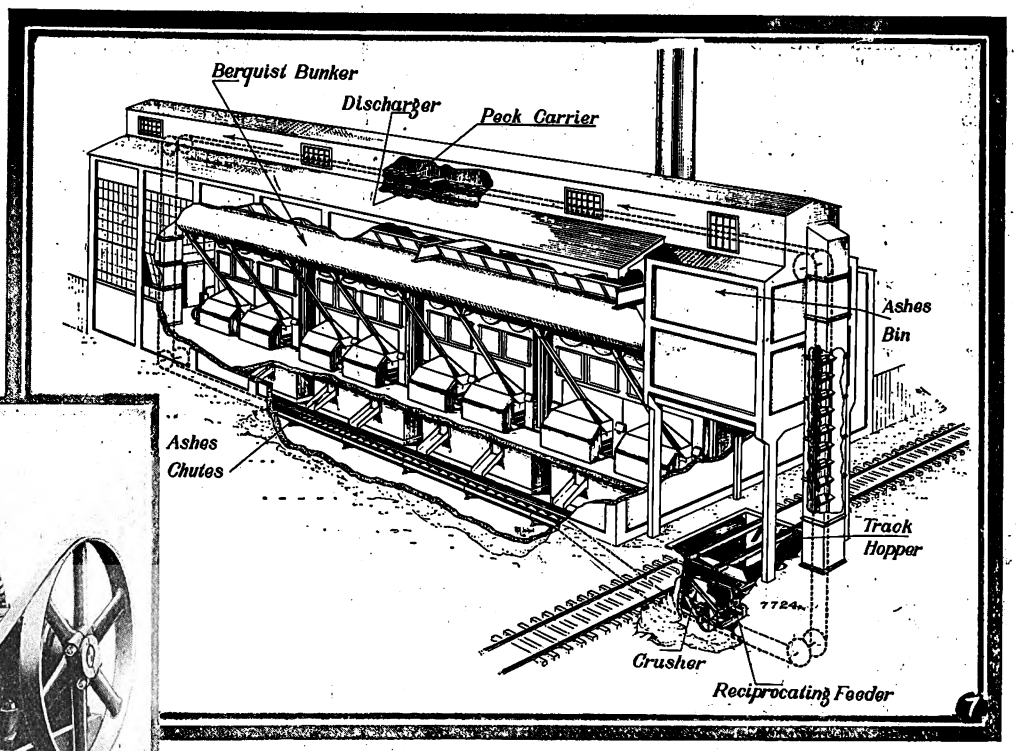


Fig. 7. A complete modern coal handling system is shown in this illustration. Such equipment is designed to stand the rugged service demanded of it, but neglect or lack of regular inspection may result in trouble, particularly at the crusher. Belt troubles may be due to poor alignment or to rock, iron, etc., getting into the crusher.

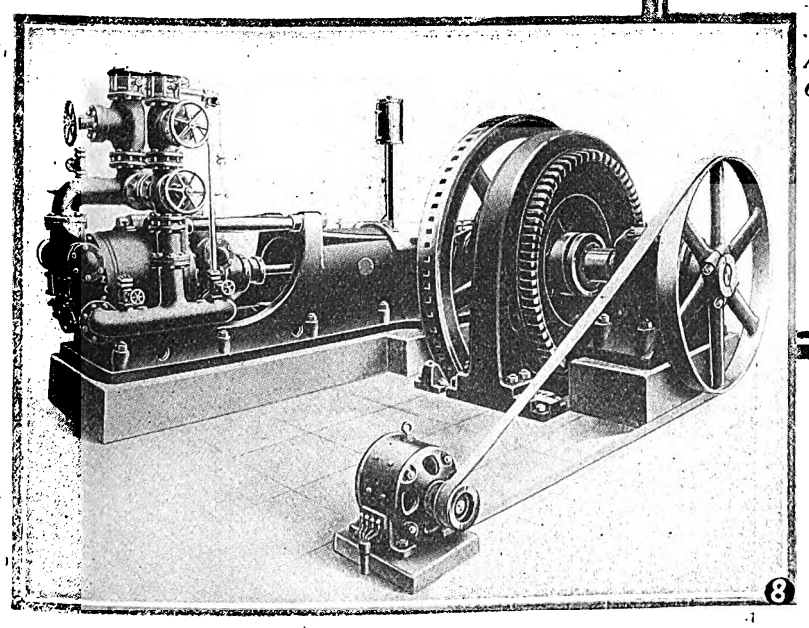


Fig. 8. Motor-driven units are numerous in manufacturing plants today. The illustration shows an ammonia compressor direct connected to a synchronous motor. With such a prime mover, maintenance troubles are very small.

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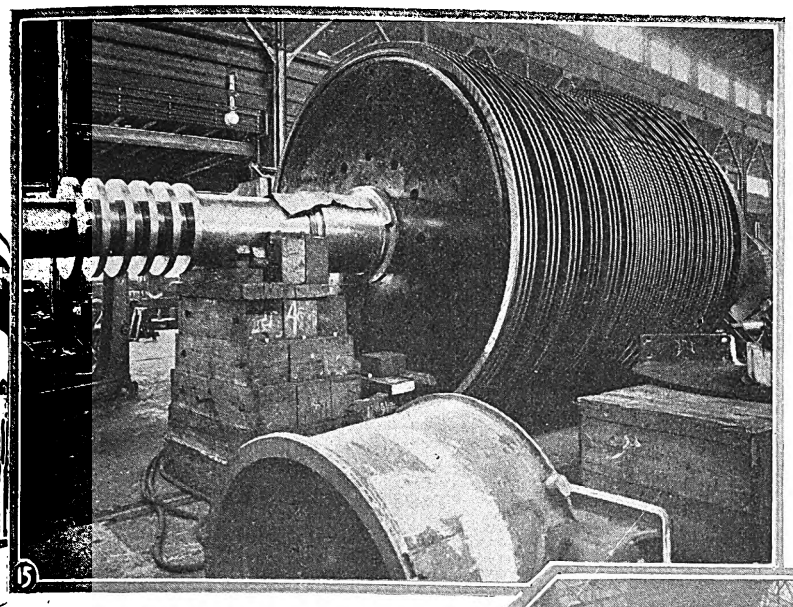


Fig. 15. Showing the rotor of a steam turbine before it is placed in its casing. The importance of a continual supply of lubricating oil to the thrust bearing of such turbines should be emphasized.

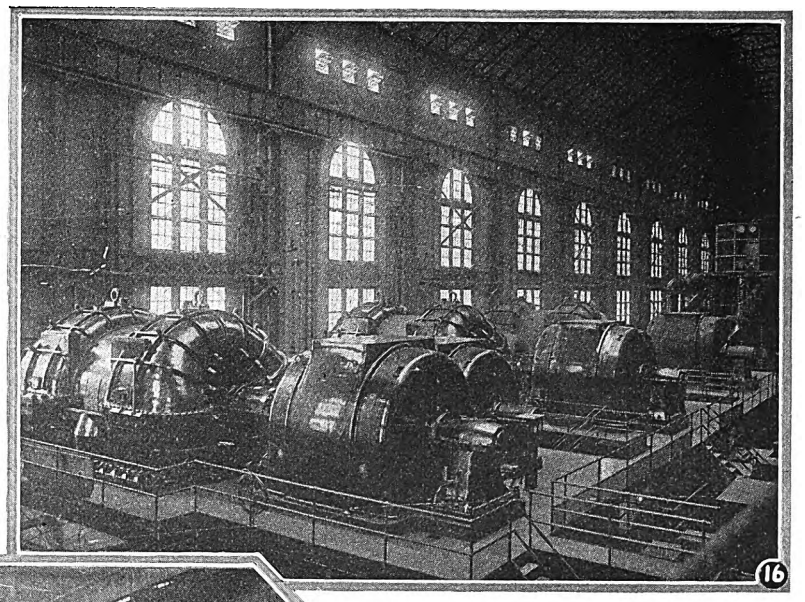


Fig. 16. Turbo-generating units in a large central station in the East. The sensitiveness of such equipment to automatic control is a distinguishing feature of its operation, and all parts must, therefore, be maintained in proper, smooth working order and adequately lubricated.

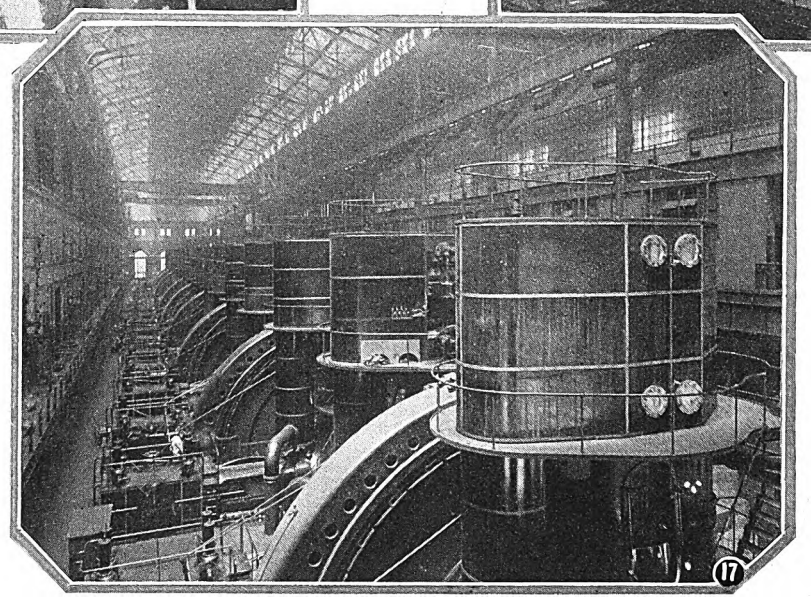


Fig. 17. A large central station showing the installation of large angle compound Corliss engines direct-connected to electrical generators. Maintenance and repair costs in such stations are usually kept at a minimum by constant and thorough supervision and inspection.

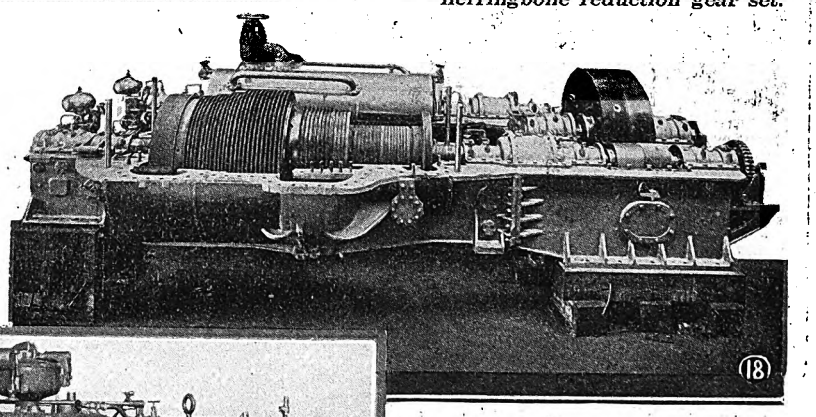


Fig. 18. A large multi-stage geared turbine unit with the upper casing removed and showing the multiplicity of blades in the rotor, as well as the herringbone reduction gear set.

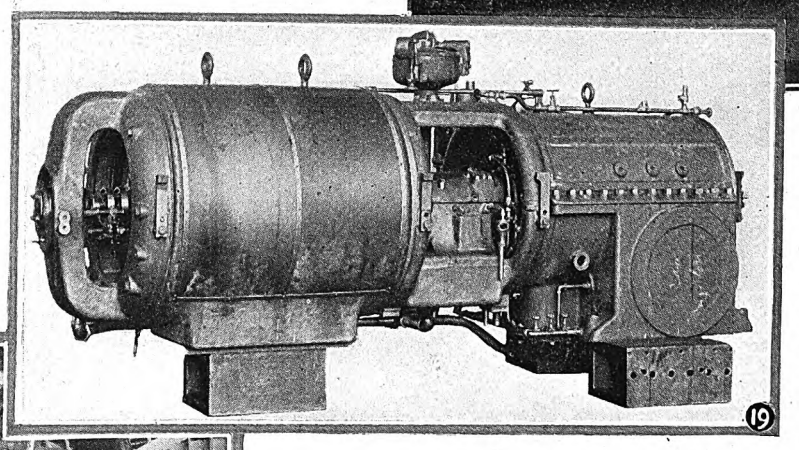


Fig. 19. Turbo-generator units rigidly mounted upon the same bed plate and direct-connected seldom give much trouble due to misalignment. Lubrication remains a vital factor due to the high rotative speeds, and the gages should be carefully watched at all times.

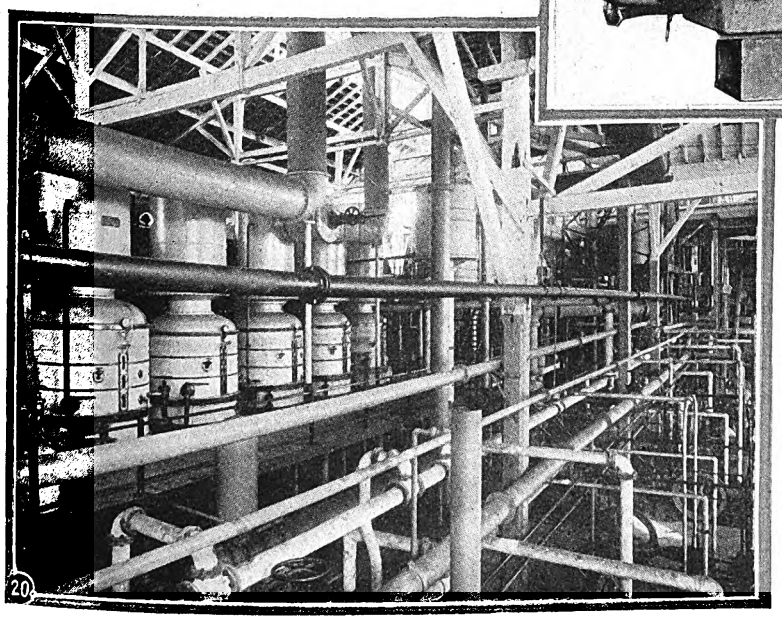


Fig. 20. Maintenance of pipe lines is a large item in many plants where they form the labyrinth of devious paths for water and steam, as indicated here. Tight joints and valves and adequate insulation are necessary to economical operation.

ical, but it is impossible to give proper attention to boiler cleaning, since both units are required to supply the week-day load.

In plants of moderate size, it is good practice to have at least two spare boilers. One boiler is always down for cleaning and general overhauling and another is in reserve for emergencies. Where feed water treatment is inadequate and the formation of scale is rapid, it may be advisable to have more than two spares, so that proper attention to cleaning can be given.

Neglect of internal and external cleaning of boiler surfaces causes excessive heating and strains in the boiler structure and may often result in blistering or bagging of the boiler metal and possibly even a blown out tube or boiler explosion.

There is no definite rule as to the frequency of cleaning. That depends upon the plant conditions, the character of the feed water. Scale must not be permitted to accumulate, however, since it not only prevents economical operation, but lessens the capacity and life of the boiler and introduces an element of danger in the otherwise safe operation of the plant.

Furnace maintenance and the maintenance of arches is closely associated with the operation of the plants and the control of the draft and fires. Furnace repairs result largely from improper operating con-

(*Continued on page 76*)

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Good Lighting

By M.

Director, Laboratory of Applied Science, National

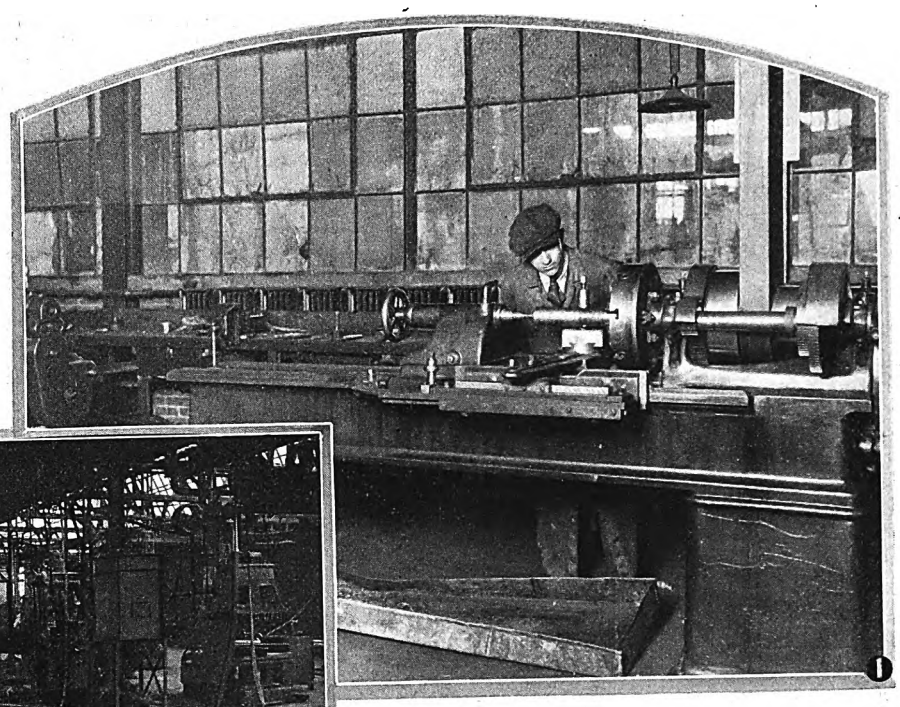


Fig. 1. The windows behind this operator are useless, owing to years of neglect. They are practically opaque, due to the collection of carbon scale, etc.

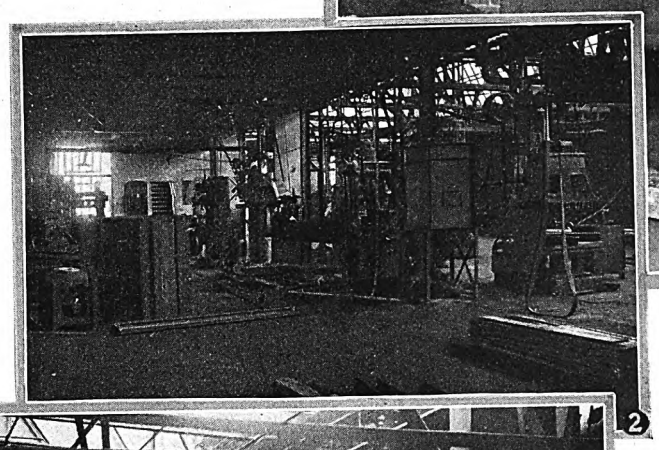


Fig. 2. Before cleaning the glass. See Fig. 3.

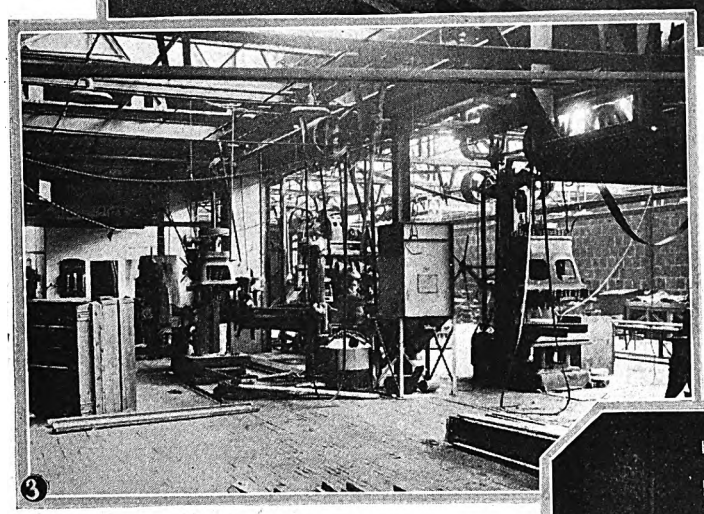


Fig. 3. After cleaning the glass. Compare with Fig. 2. The photographic exposure was the same as that for Fig. 2.

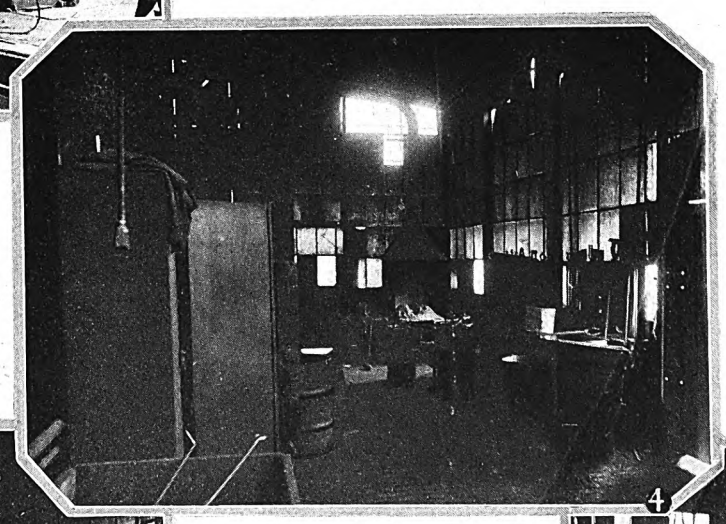


Fig. 4. The daylighting has become almost zero owing to neglected glass areas. The illumination intensity was 0.7 foot-candles.

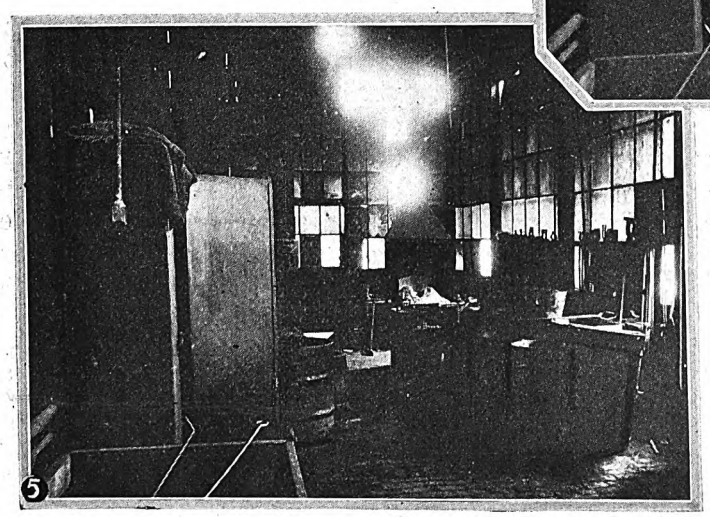


Fig. 5. The condition of Fig. 4 was barely improved with the very poor artificial lighting.



Fig. 6. The windows shown in Figs. 4 and 5 were cleaned with a good cleaning compound. The result is obvious. The illumination intensity increased from 0.7 foot-candle to 15 foot-candles.

IN this highly artificial age we cannot escape the fact that our working and living conditions differ in many respects from those under which mankind evolved through countless thousands of years. The human race was born in the natural world completely subject to Nature. What distinguishes primitive man in the ranks of the animal kingdom is his tendency to construct an artificial world by using the secrets which he wrested from Nature. It is true that animals possessed the instinct of self preservation and as a consequence burrowed into the ground for shelter or otherwise provided protection. However, certain animals gradually went further and used fire, developed weapons, and used tools. These started on the pathway to present civilization, leaving all other animals far behind in the struggles of countless ages.

In order to account for many of our characteristics we must go back in our imagination to the environments through which the evolution of mankind passed. Light is one of the primary essentials to life as we know it. The great natural illuminant throughout the ages has been daylight. To its quality or color the visual process is best adapted, for we cannot avoid the acceptance of the fundamental principles of evolution. To its distribution the retina and physiognomy adapted themselves

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and Prosperity

LUCKIESH
Lamp Works of the General Electric Co.

The light came from above—from the sun and from the sky—and the forehead projected to form protection from the glare. Today we still feel the effects of those countless centuries of adaptation because light from below the horizontal is more glaring and discomforting than light from above.

We must also consider the quality of daylight. The sun contributes most of the daylight which reaches the earth's surface outdoors on a clear day. On such a day the sky contributes about 15 to 20 per cent. usually. It is the most natural consequence that the light reaching the earth outdoors from sun, sky, and clouds should appear colorless to us and that our standard illuminant for color discrimination is average daylight. The color of an object is not merely inherent in the object but depends largely upon the illuminant. For these reasons it is easy to see why daylight is a standard illuminant for mankind. If the illuminant had any other characteristic the visual factors would adapt themselves to it if the period of adaptation extended over a sufficiently long time, which doubtless is a matter of centuries at least.

Now let us come indoors as mankind did for a portion of the time at least. Coming indoors imposed certain other influences. The light reaching indoors from openings in walls

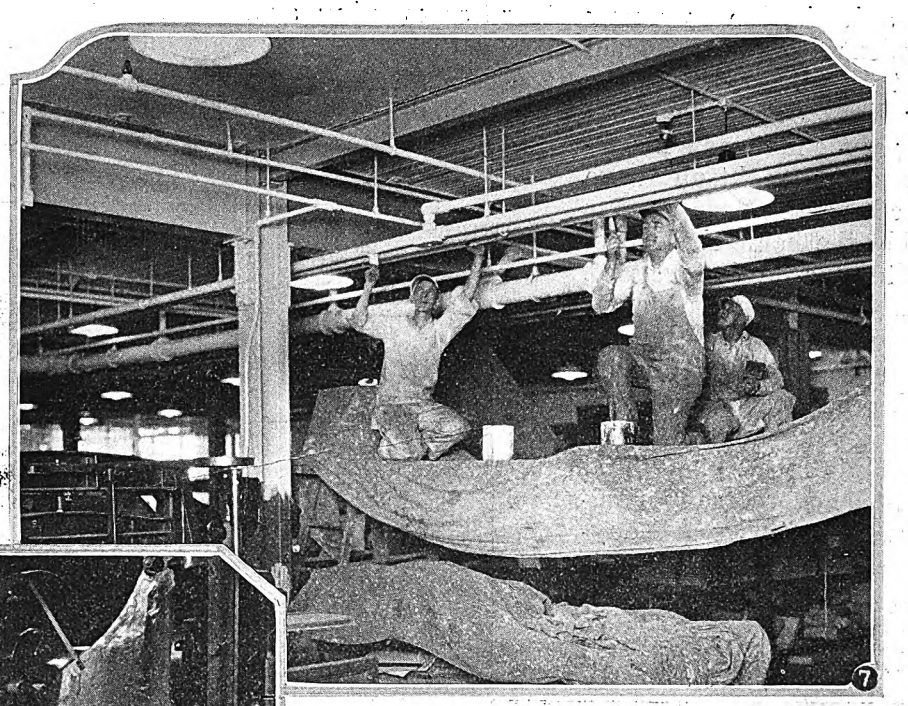


Fig. 7. The painter is a valuable ally of the lighting installation. He eliminates walls that absorb light.

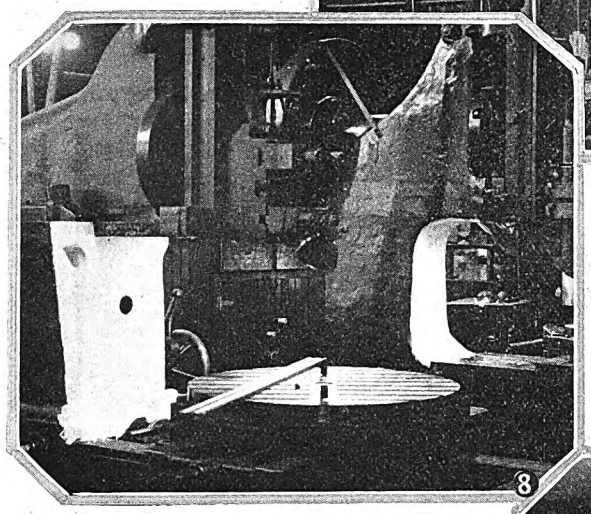


Fig. 8. Paint (flat white) aids diffusion, increases the amount of light on the work, and reduces glare.



Fig. 9. A lamp factory believes in its own product. It uses a high intensity of general lighting and many lamps for localized lighting where very high intensities are desired.



Fig. 10. The forest of belting as found in this screw-machine room, does not prevent an adequate supply of properly diffused lighting reaching the work from the overhead system.

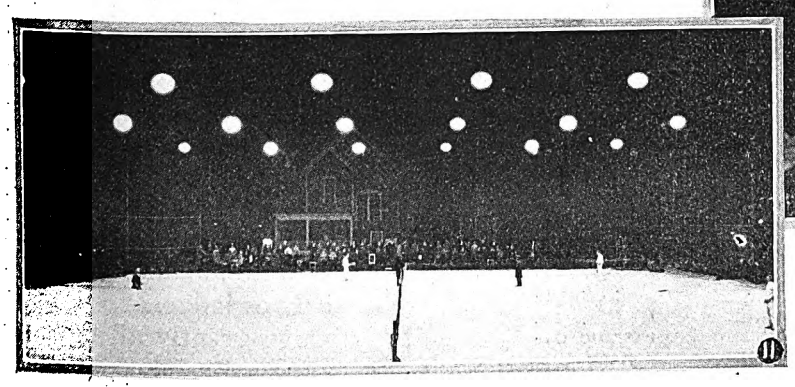


Fig. 11. Employees play tennis outdoors at night.

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was now chiefly skylight. On a clear day this is a bluish white light and on a cloudy day it is more nearly white. Fire was one of the chief reasons why man became partially an indoor animal. He was now independent of Nature when daylight failed. Owing to the meager light obtainable from burning crude materials his activities after nightfall were slackened. Nevertheless, this fire made the home-circle possible after the day's foraging. Thus, the light from flames has become a natural illuminant ever associated by mankind with the security and comfort of home. However, the long adaptation to daylight could not be overcome in a relatively few centuries and daylight is still the best quality of light for vision of the completest character.

On coming indoors mankind imposed certain restrictions on daylight. The tremendous intensities running as high as 10,000 foot-candles at noon on a clear summer's day could not be brought indoors. Roofs, walls, adjacent buildings, structural requirements and growing congestion of building, have all combined to reduce the daylight intensities to a fraction of their outdoor value. When glass areas are not properly maintained or cleaned these restricted intensities are still further reduced and finally, of course, can reach zero. A great deal of work has been done in designing glass areas for buildings but a discussion of this phase is beyond the scope of this article. It is sufficient to state that the tendency is to consider the sky as the light-source and to exclude or to diffuse the direct sunlight. Incidentally, there is a general impression that oftimes we have too much light. That this is erroneous is easily proved by actual measurements. Outdoors we are subjected to an intensity of thousands of foot-candles during many hours of the day. Indoors under good daylighting conditions we seldom find a hundred foot-candles. Under poor daylighting and ordinary artificial lighting conditions we have an intensity of only a few foot-candles. When one suspects that there is too much light it is well to inquire into the manner of its use and into various visual factors, such as contrast, brightness of walls, diffusion of light, position of windows and lighting units, etc. The difficulty will be found among such factors. By considering the high intensities of illumination under which mankind has evolved and by studying physiological laws the conclusion is reached that illumination intensities, for both daylight and artificial light, are very often too small for the best working conditions. Of course, the solutions are adequate and proper glass areas well maintained and approved artificial lighting units properly installed and maintained. Although there is much still unknown in regard to light and human activities, enough knowledge is available to improve greatly all lighting

(Continued on page 81)

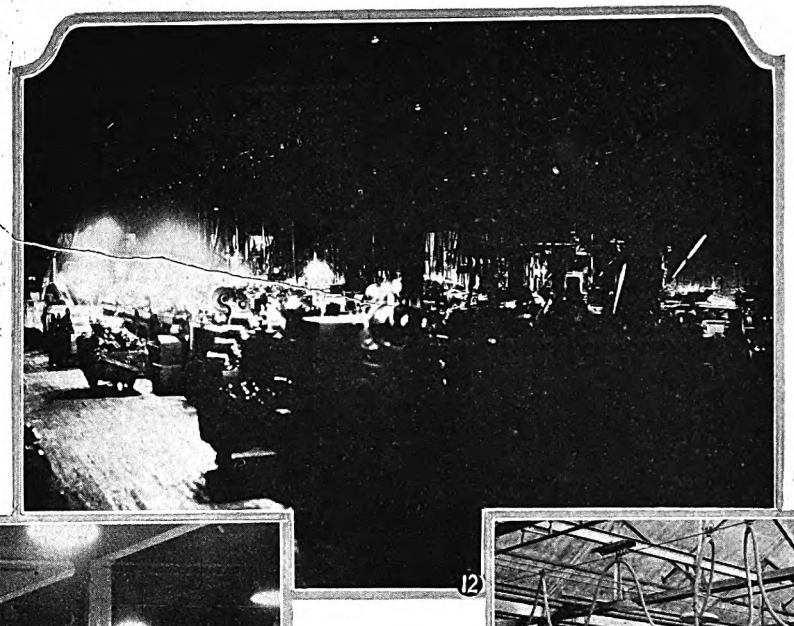


Fig. 12. This represents the actual condition in a certain factory recently. The average illumination intensity was 0.2 foot-candles.



Fig. 13. This represents the condition in the same room as represented in Fig. 12 after rehabilitating the lighting system. The average illumination intensity is now from 6 to 10 foot-candles. The management of this factory is highly enthusiastic over the possibilities of good lighting.

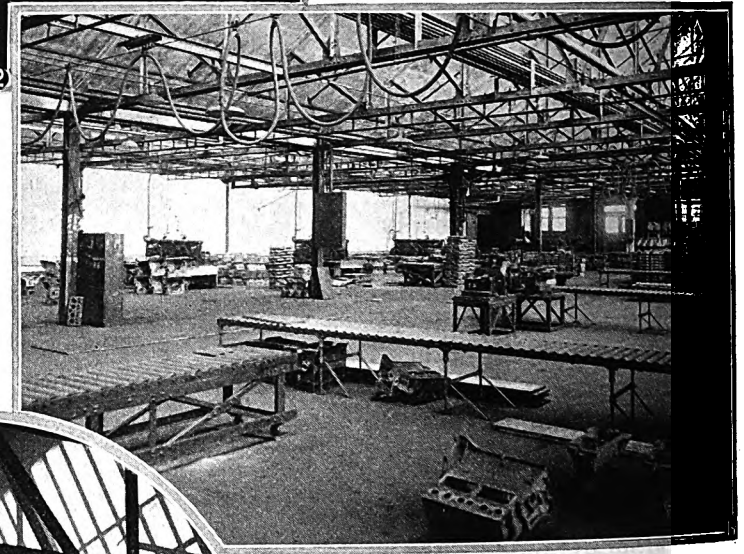


Fig. 14. Good daylighting in a factory.

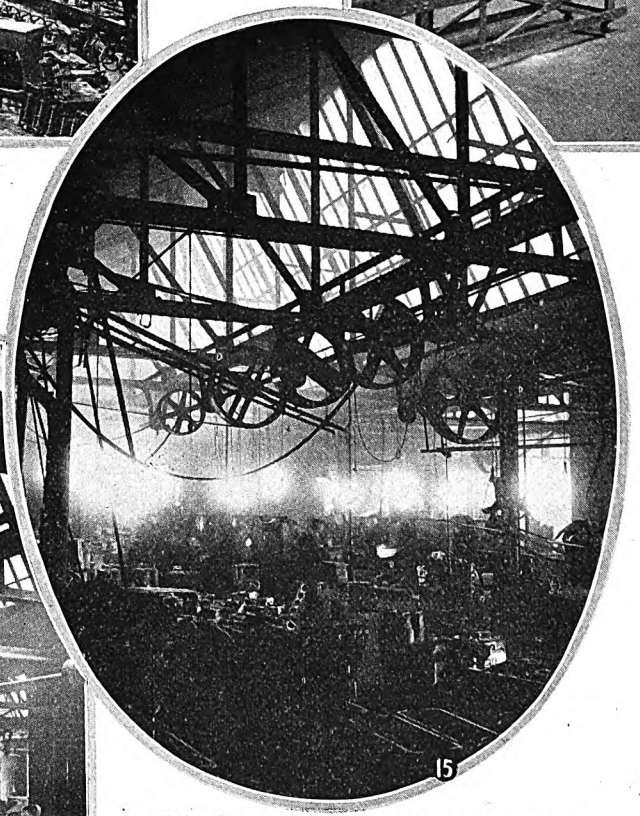


Fig. 15. Dirty skylights and poor artificial lighting.

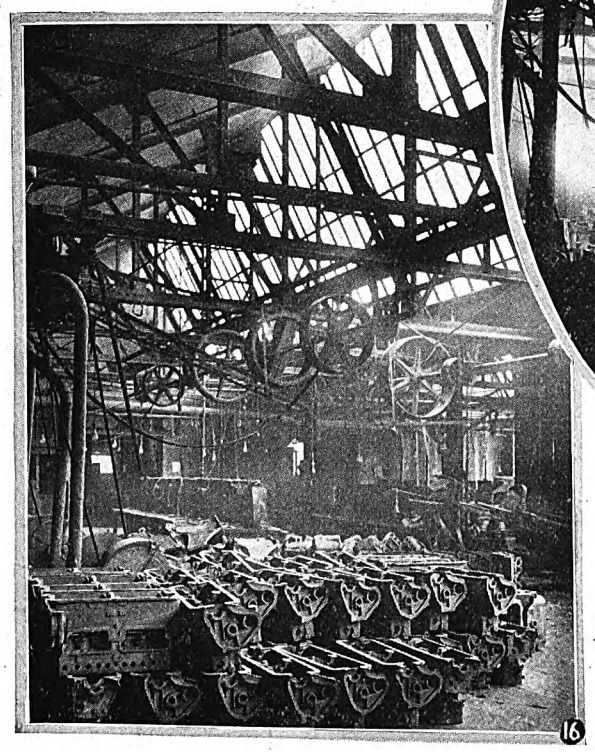


Fig. 16. The condition after the skylights were cleaned. Compare with Fig. 15. The two photographs had the same exposure.

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A Basic Industry in Our Biggest Territory

BY D. M. LE BOURDAIS

ALASKA is a country of surprises, but perhaps nothing in that at land is so remarkable as great strides with which reindeer industry has adnced in the comparatively v years since its inception. ost of us are more or less niliar with the reindeer from ancy; for has not Santa aus always driven a bound- team of them throughout land on frosty Christmas hts? But that, however, is out the full extent of our owledge of this most intering animal.

Yet there are millions of ople in the world whose dendence upon the reindeer is solute. In northern Nory and Sweden, in Finland d Lapland, and right across e northern part of Asiatic ssia the reindeer supplies st of the people with most their needs. In the first ace it supplies food—meat d milk; then its hide is use- for making clothes, tents d even boats; and, lastly, it employed as a beast of bur- n, either driven in sledges or lden.

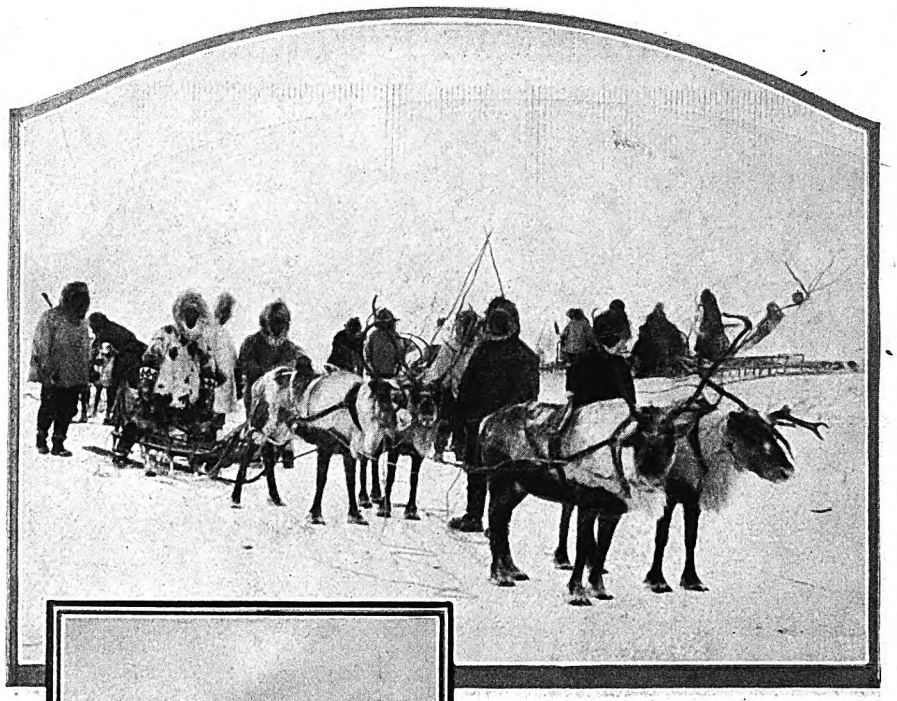
If you were to ask a scien- t to describe a reindeer, he uld be likely to answer some- hat as follows:

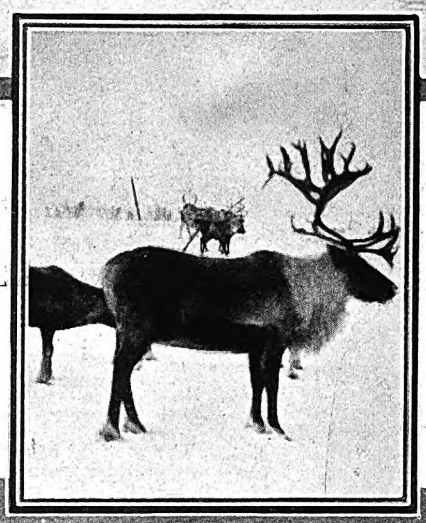
The reindeer is an antlered, erbivorous, graminivorous, uminant ungulate, and a emi-migratory but gregaious animal, of the family Cervidae, the genus Rangifer, and the species Rangifer tarandus.

All of which would be quite true—at least that is the way Judge Lomen, of Nome, Alaska, has described it in an article in the "Journal of Heredity," and he was not joking either. But to get down to language which we all understand, the reindeer is an animal having antlers like most deer excepting that in the reindeer both sexes have them. It eats the rich grass which grows on the Arctic prairies, lichens, the foliage of low trees and bushes and the deep, thick moss which is a feature of the Arctic tundras. When it has fed it lies down in a quiet place and, like a cow or sheep, chews its cud. Also like a sheep or cow it has a split hoof. It is inclined to move about from place to place at certain periods of the year, spending one season in a certain part of the country and the other somewhere else, but with no apparent regularity; and when it moves it does so in large herds.

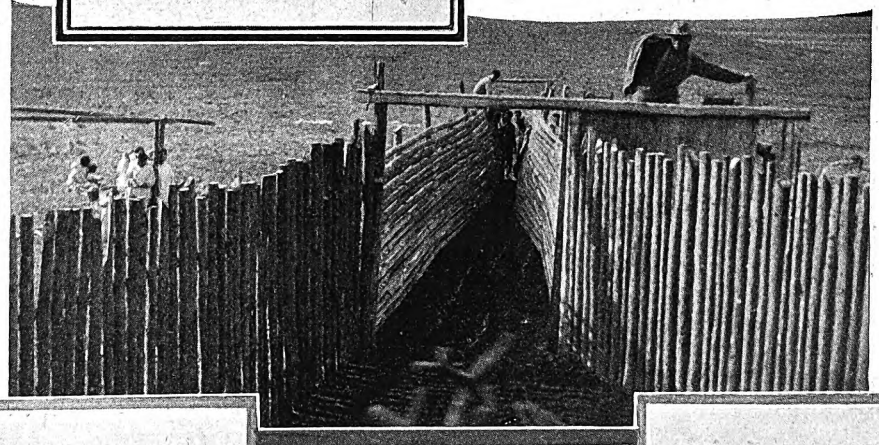
That is about what Judge Lomen meant when he said in a few long words what I have said at some length in more or less short words. I might also have said that a full grown reindeer is about four and one-half feet in height and about seven feet in length from nose to tail. In color it is usually

(*Continued on page 71*)

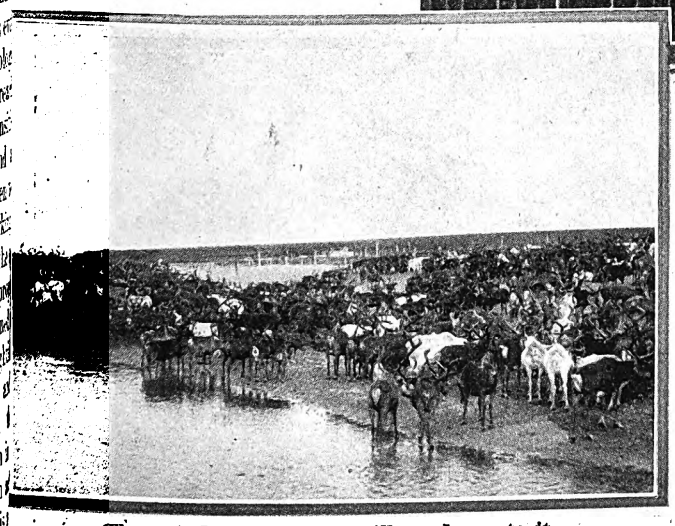




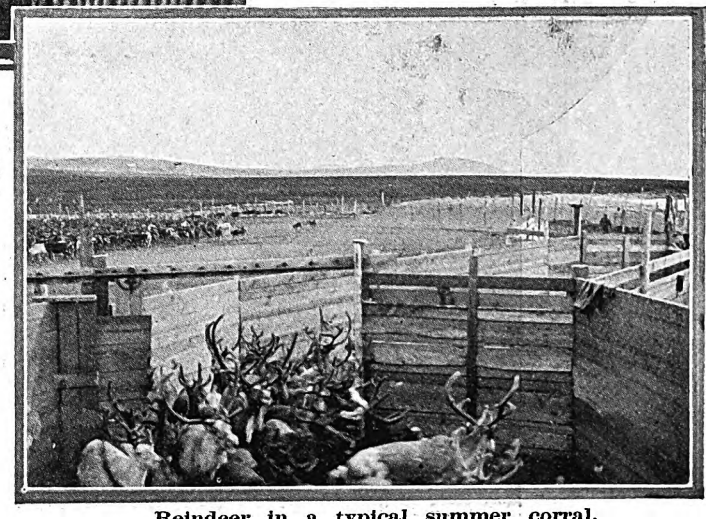
The reindeer are very fleet when not too heavily laden. The record time for ten miles (two deer to a sled) is 27 minutes, 20 seconds.



The reindeer are driven through chutes such as the above, being marked for identification as they pass through.



The reindeer supplies milk and meat; it is employed as a beast of burden; and its hide furnishes clothes, tents, and even boats.



Reindeer in a typical summer corral. Many people, incidentally, fail to realize that Alaska's summer climate rivals our own.

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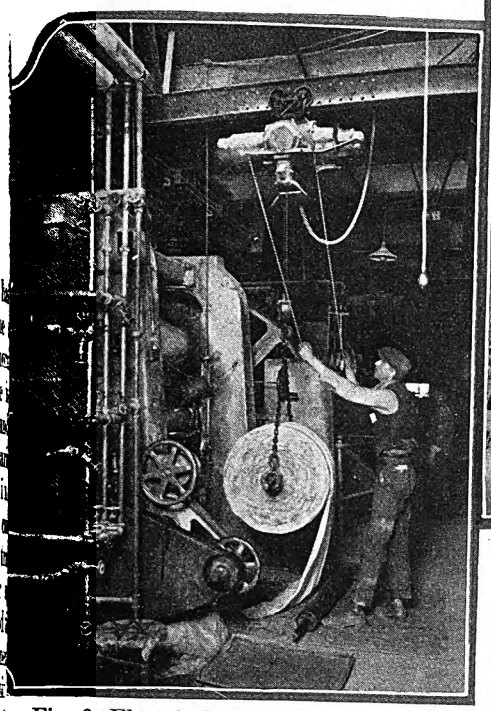


Fig. 6. Electric hoists are on the job 24 hours a day, and can be operated at a moment's notice. By being attached to trolley monorails they can be made to serve more than one piece of equipment.

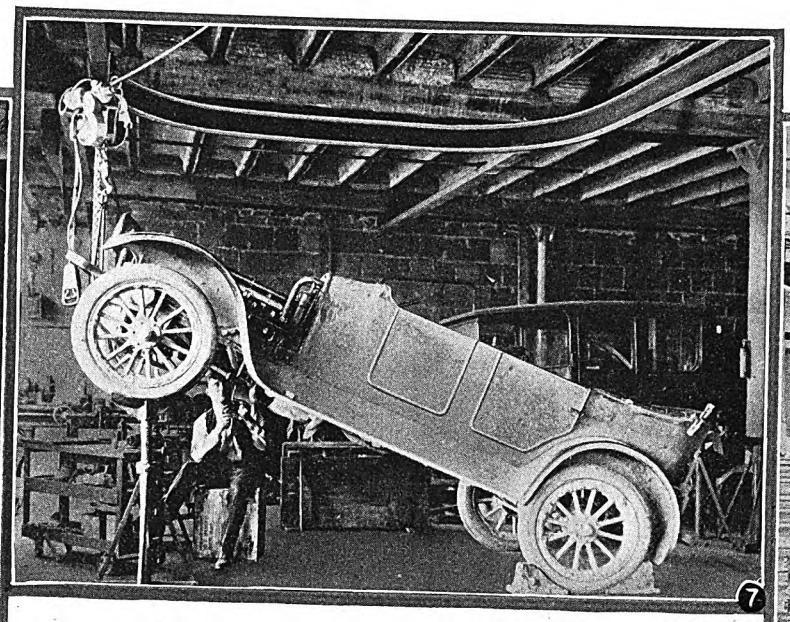


Fig. 7. The small pant, as well as the large plant, finds many uses for monorail equipment. Note adjustable stand and movable bench with tools to work with while under the car and blocks under rear wheels. This equipment reduced the time on jobs by 50%, and made the work light and convenient.

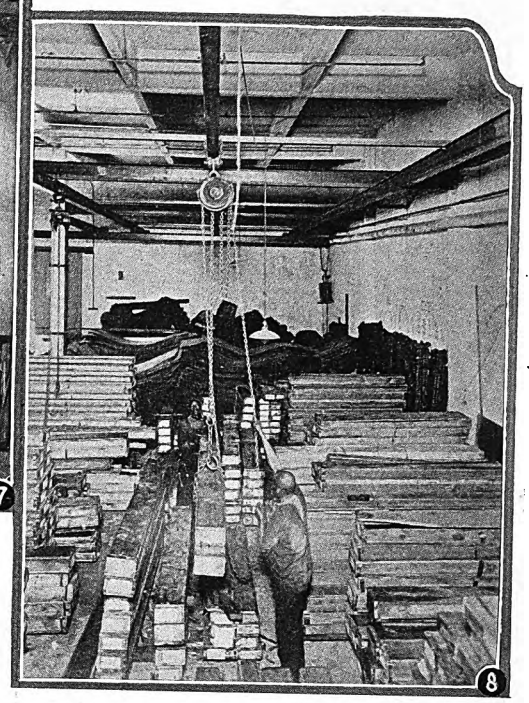


Fig. 8. The use of chain hoists and trolley monorails in this steel warehouse increased storage space 50%, as it was possible to pile the material higher. In addition, the loads are carried on a trolley and I-beam system from one to 50 feet.

a) Hand hoist (Includes all makes and designs where the lifting force is obtained by the direct application and effort of man power.)

b) Pneumatic hoist (Includes all makes and designs where the lifting force is obtained by the direct application of the pneumatic principle.)

c) Electric hoist (Includes all makes and designs where the lifting force is obtained by the direct application of electric power.)

The above hoists can be either cable, rope or chain type, and also classified under many detailed headings, but a generalization is necessary in order to simplify the use of terms.

d) Monorails: (This term applies to all overhead carrying systems where only one rail is used to carry the load. This rail does not have to be a standard I-beam rail, but can be built-up or special section.)

Trolley: (This term applies to the use of a set of wheels for operating on a monorail, where man power is used or the wheels are propelled by a telpher.)

Telpher: (This term applies to a set of wheels for operating on a monorail, where either gas or

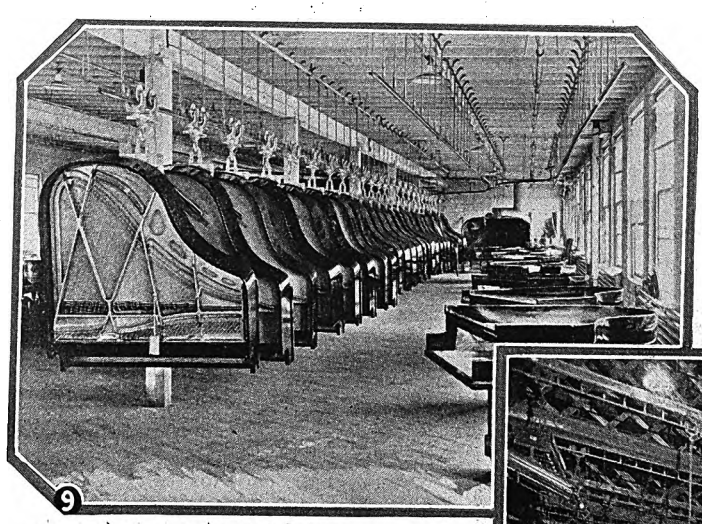


Fig. 9. The Apollo Piano Company have found trucking on the ceiling to be the most economical means of handling grand pianos. This view was taken in the varnishing department.

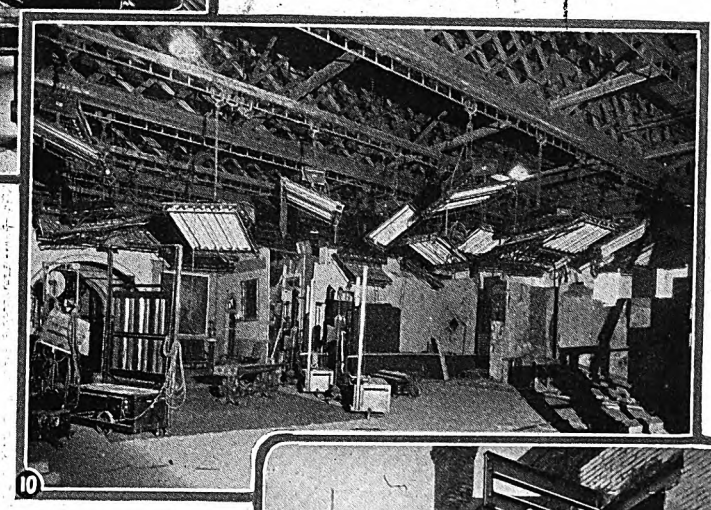


Fig. 10. Industrial plans are not the only users of overhead equipment. Even the movie industries have found it advantageous for shifting sets, and holding lighting effects.

Fig. 12. Building contractors have found hoists and trolley monorails of great assistance in laying stone work and placing heavy beams on new construction.

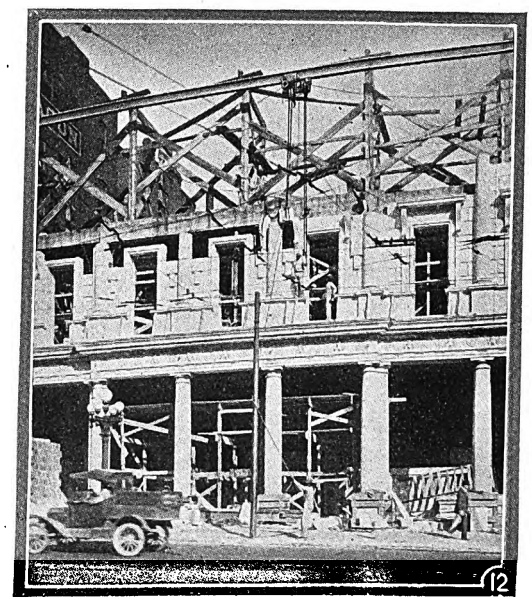
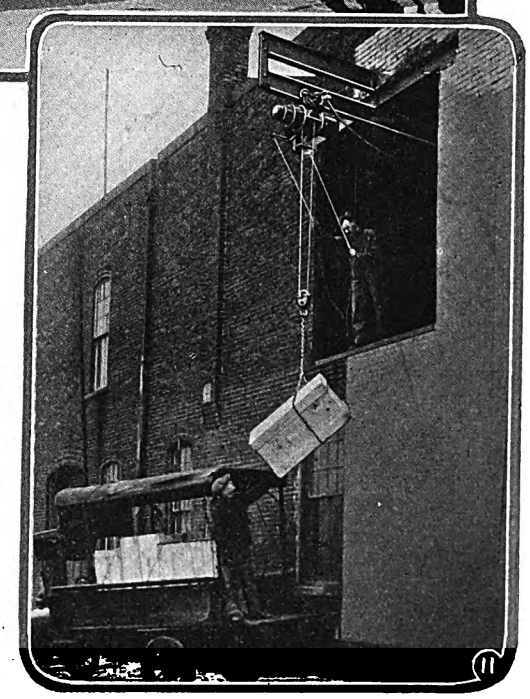


Fig. 11. The electric hoist and overhead trolley monorail installed as shown on the right saved $2,200 on the initial investment, which would have been required for putting in a freight elevator.



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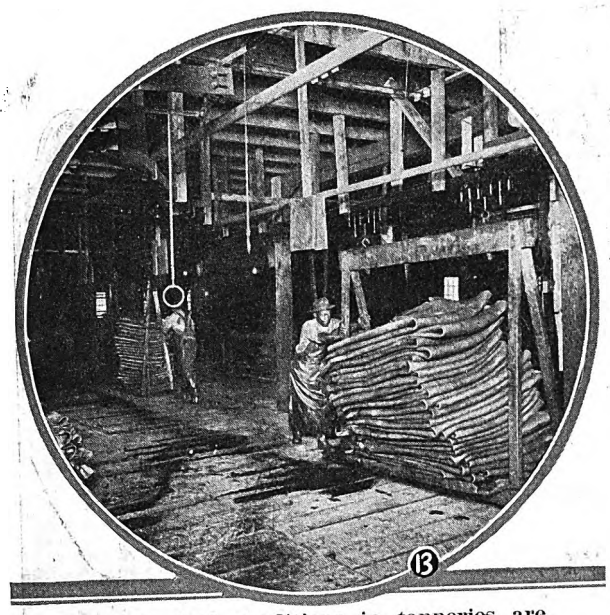


Fig. 13. Acid conditions in tanneries are hard on trucking equipment. The overhead monorail is out of the way and free from moisture.

Fig. 14. This is an installation in one of the largest mill supply houses in the country. Accurate records of operating costs show that the electric chain hoists and trolley monorails have saved the wages of four men previously employed in handling pipe at this warehouse.

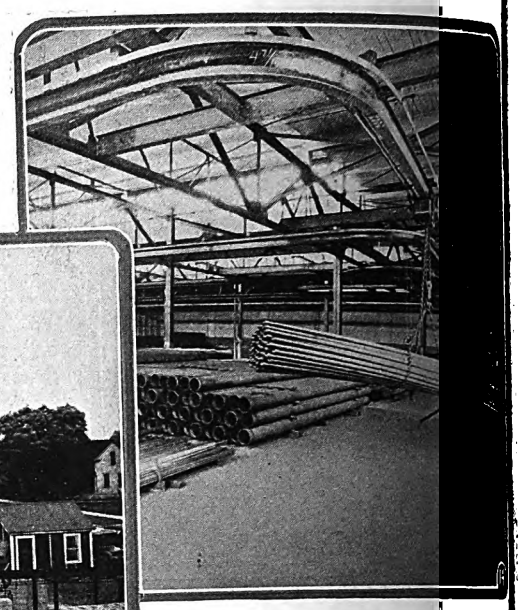
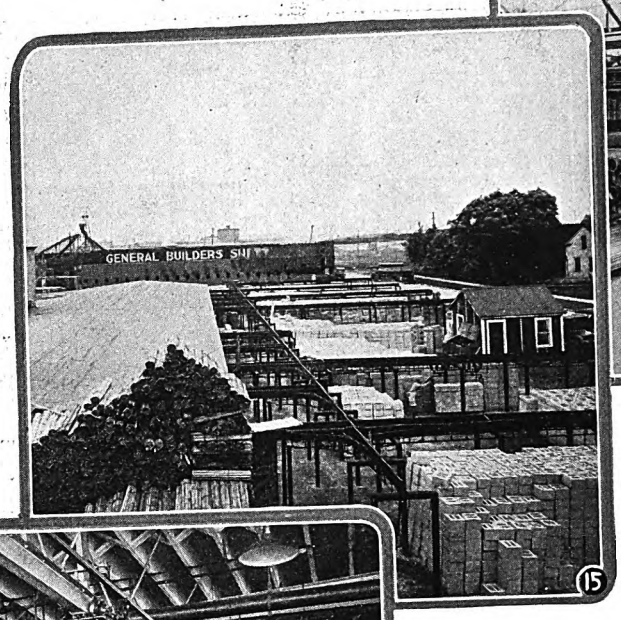


Fig. 15. Trucking over rough ground is difficult and roadways are expensive. Light duty monorail systems to feed the yard and buildings can be installed cheaply.



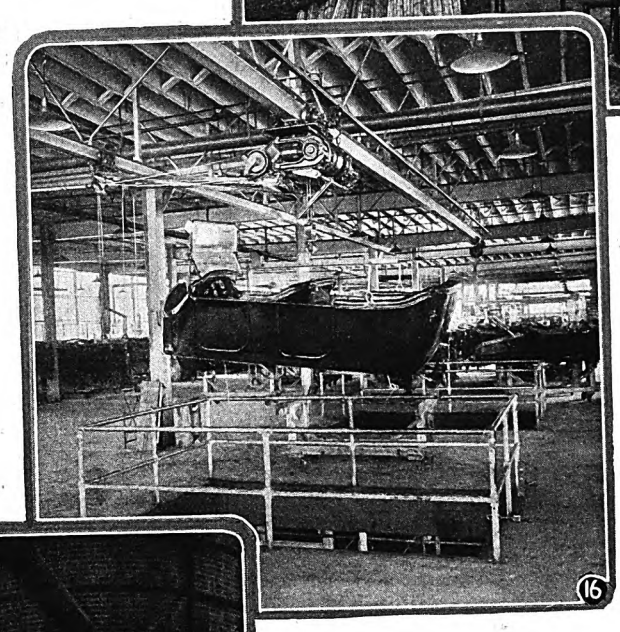


Fig. 17. The B-O-T pottery company, Trenton, N. J. use the over-head system of transportation throughout their plant. Notice the load that one man moves quickly, easily and without breakage. The canopy over the carrier is to keep dust and dirt from falling on the fixtures before they are baked.

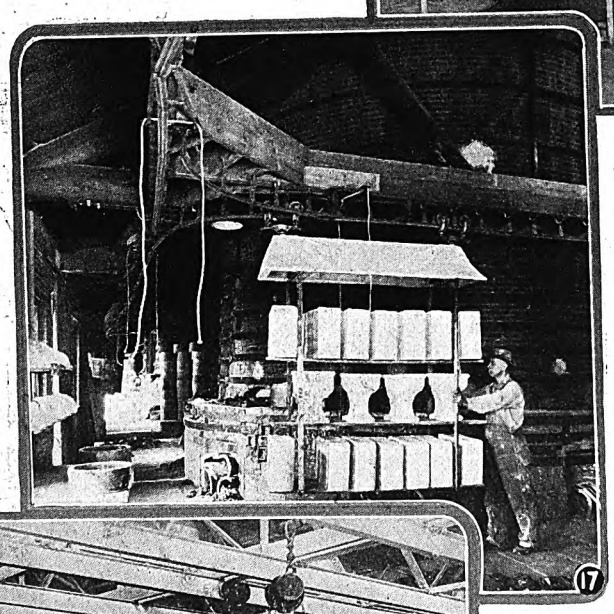


Fig. 16. The hoist is one of the vital parts of the overhead conveying system. This hoist, with special controls is used for lowering finished bodies from second to first floor and on to a body conveyor.

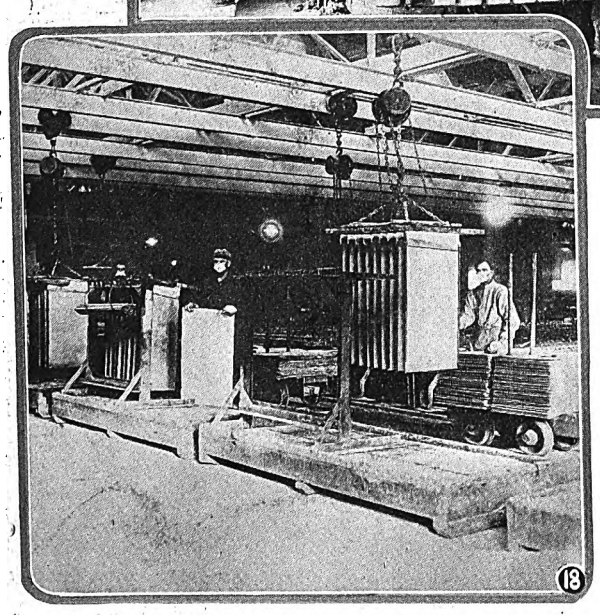


Fig. 18. Trolley monorails operating in the copper refining process where it would be impossible to handle this material with any other type of equipment.

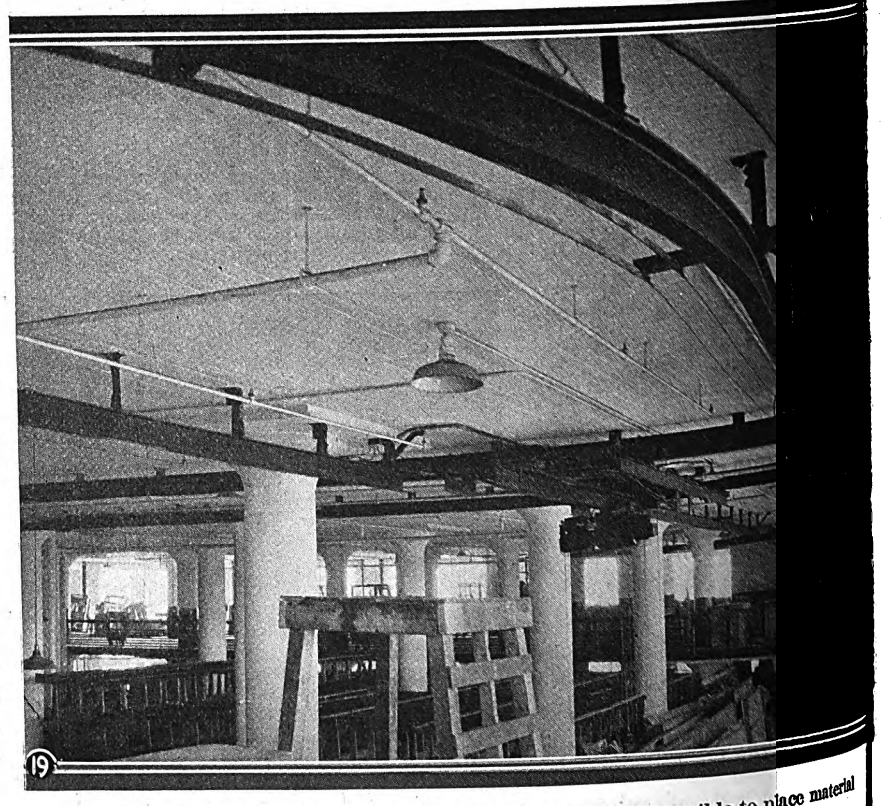


Fig. 19. Transfer cranes in each bay make it possible to place material on any part of the floor.

electric power is used t
move the telpher, and t
phers will be known und
two headings as plain t
phers or cab-operated t
phers, in case a cab is a
tached to carry an ope
ator.)

By studying these terms,
will be easy to see that va
ous types of hoists are re
separate pieces of equipme
and as such, may be used in
vidually, just simply for ho
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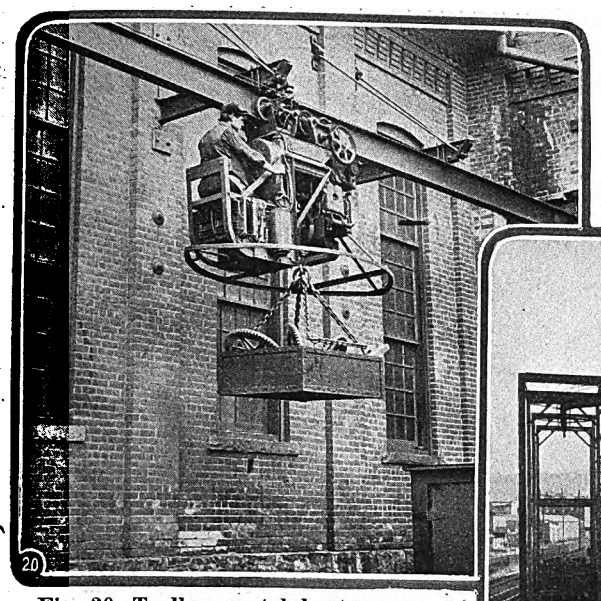


Fig. 20. Trolley or telpher monorails do not have to be supported by expensive super-structures, but can be hung from the side of the buildings or on existing structures.

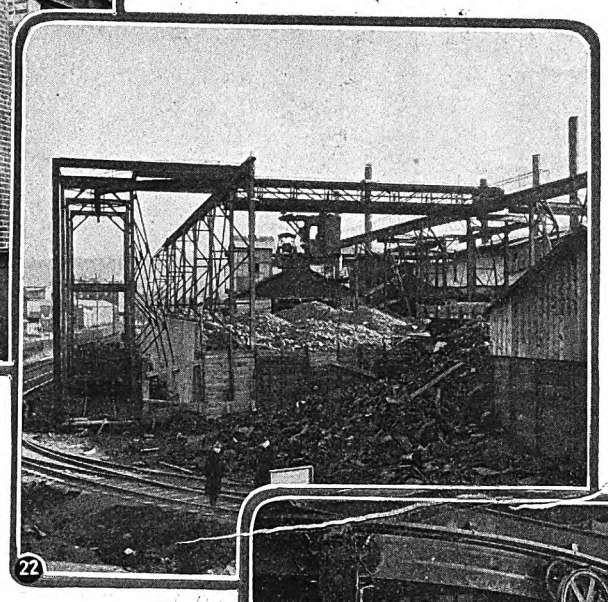


Fig. 22. General view of coal storage yard of the American Car & Foundry Company, showing additional spur for unloading car on siding.

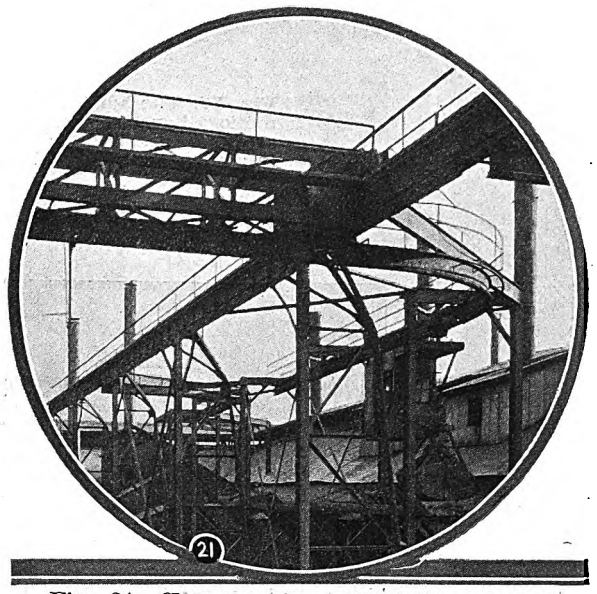


Fig. 21. Close-up view of telpher-monorail showing spurs and transfer crane in the coal handling system of the American Car & Foundry Co.

The monorail itself is nothing more than a carrying medium for the other equipment.

The monorail or telpher system has been termed the aerial railway of industry, and any study of this system of transportation must take into consideration the fact that the monorail system is a *rail* way system, and is subject to the advantages and disadvantages of being held to a fixed line of travel.

The simplest form of monorail equipment consists essentially of a hoist, suspended from a trolley, which may be moved along a rail. Other types consist of an electric hoist, mounted on a trolley which is electrically operated,

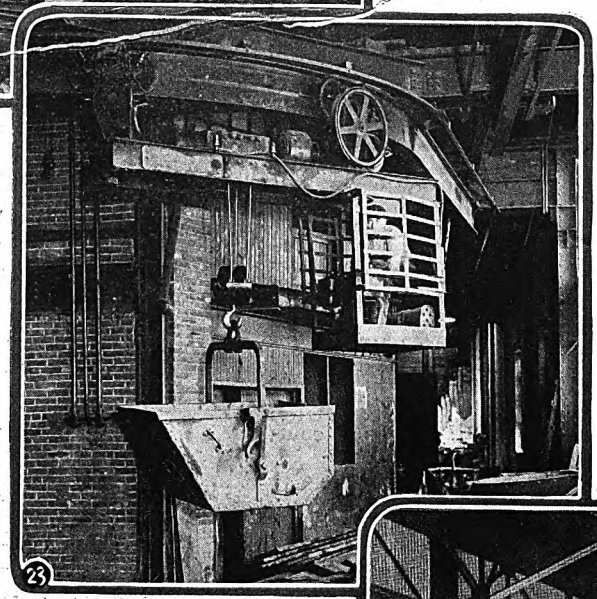


Fig. 24. View in a marine terminal shed showing telpher-monorail, where the telpher acts as a tractor and pulls two trailer hoisting units. The transfer crane in this installation forms one end of an adjustable loop.

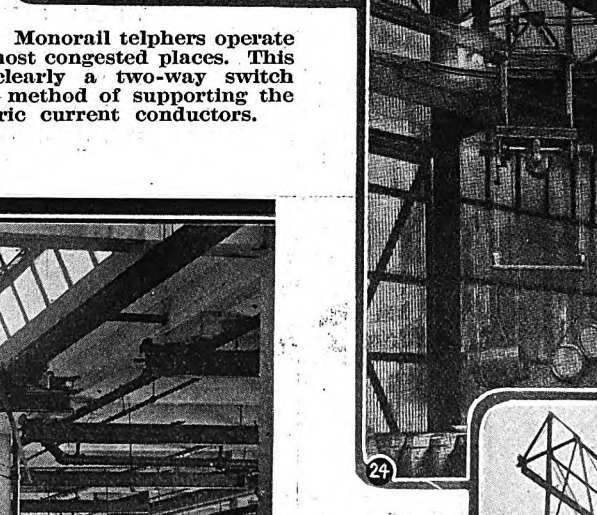


Fig. 23. Monorail telphers operate in the most congested places. This shows clearly a two-way switch and the method of supporting the electric current conductors.

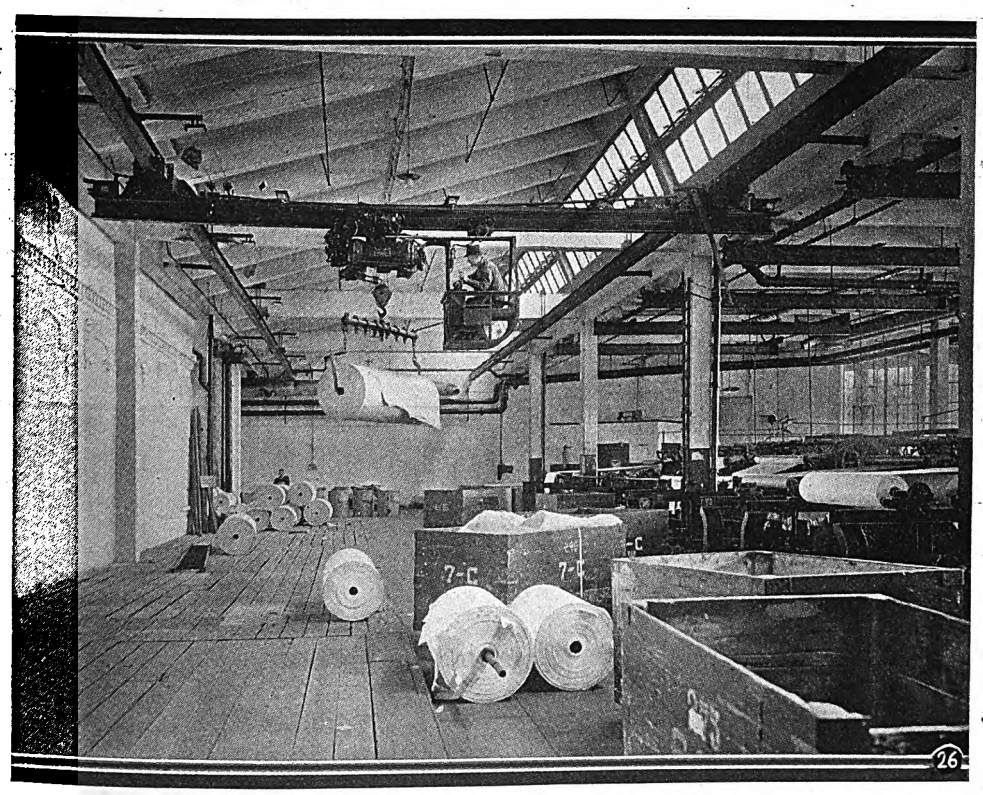


Fig. 26. Where machinery is placed close together, the telpher monorail system is indispensable. This shows the method of handling paper from storage platform to cutting machines at the plant of Dill & Collins Co., Philadelphia.

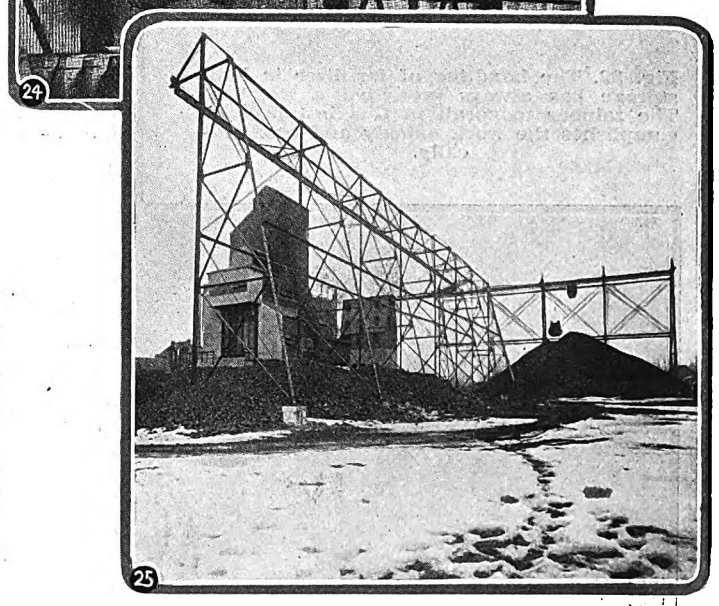
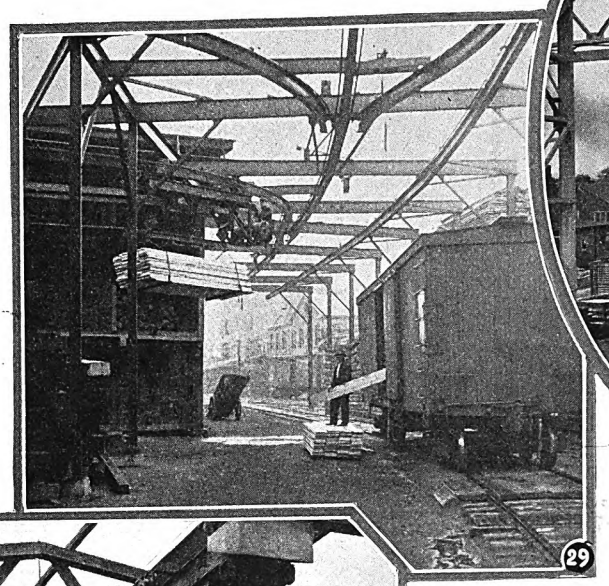


Fig. 25. Yard space is valuable for bulk storage and light super-structures give the telpher-monorail many advantages over the large cranes for conveying material as shown.

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Fig. 27. The hoist hook on the telpher monorail system can be equipped with grab bucket, sling, or magnet, depending upon the material to be handled.





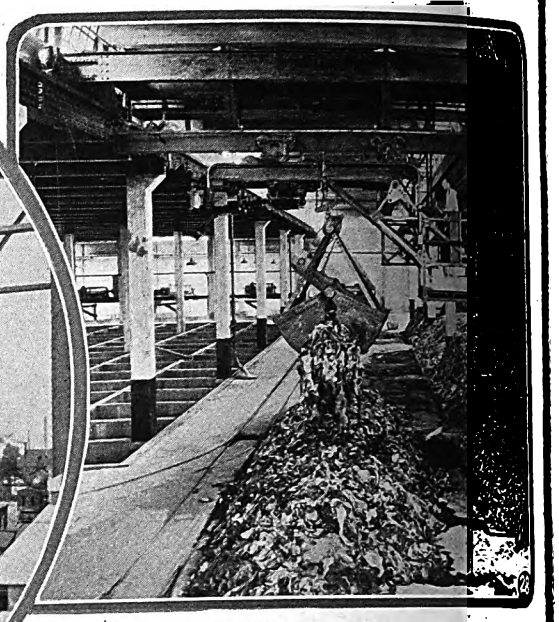


Fig. 28. This telpher monorail equipped with grab bucket has effected a saving of 50% in costs for the handling of calfskin trimmings at the plant of the U. S. Glue Co., Carrollville, Wisconsin.

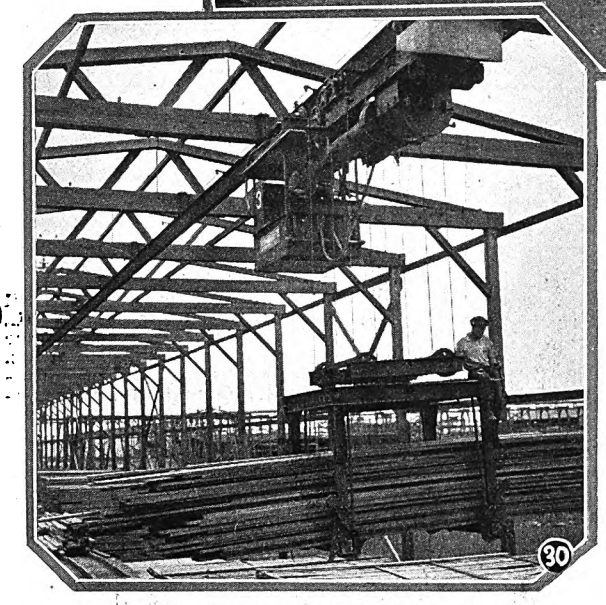


Fig. 29. Direct from car to storage pile without rehandling is the secret of the savings effected by the installation of this telpher monorail system in the plant of a large lumber company.

Fig. 30. A close view of the load grapples and super-structure for supporting the monorail. This shows one method of feeding to storage piles.

and is known as a telpher. These simple forms of equipment can be elaborated by the addition of a cab for the operator, or the trolley can be used as a trailer behind the telpher.

The electrically operated telpher from which is suspended an electric hoist, is now gaining prominence. This form of equipment is midway between the hand chain hoist and a travelling crane. The movements of the hoists are controlled by means of ropes from the floor and the operator walks along with the hoist, figure 14. This equipment is used where the machines do considerable travelling, and the distance travelled per trip is comparatively short, and there are no obstructions to prevent the operator from walking along the floor or ground. They are used in structural shops on the assembly floors to feed small parts to machines which lie slightly out of the line of travel of the crane, and in foundries, and also to carry coal to boiler rooms where the amount handled is not large. They may be adapted for remote control but some manufacturers do no recommend this, due to the possibility of accident.

The telpher-monorail consists of a hoist and trolley which is fitted with a cab and the operator accompanies the machine at all times. This equipment is subject to many modifications. For instance, it may be only the simple electric trolley and hoist to which is attached a trailer supporting the cab and control mechanism, figure 26; or it might be a large machine with an extra heavy frame, upon which are supported both the cab and

(*Continued on page 49*)

Fig. 31. While transfer cranes are somewhat more expensive, they permit the telpher-monorail a greater access to all parts of the yard. This equipment handles 270,000 board of lumber per eight-hour shift with one operator and one chaser.

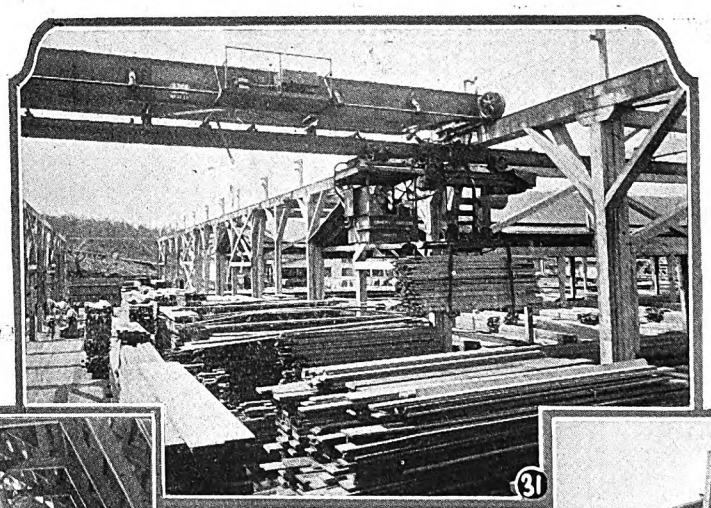


Fig. 32. The handling of fertilizer in bulk storage has always presented a problem. The telpher monorail in this instance accomplishes the work quickly and economically.

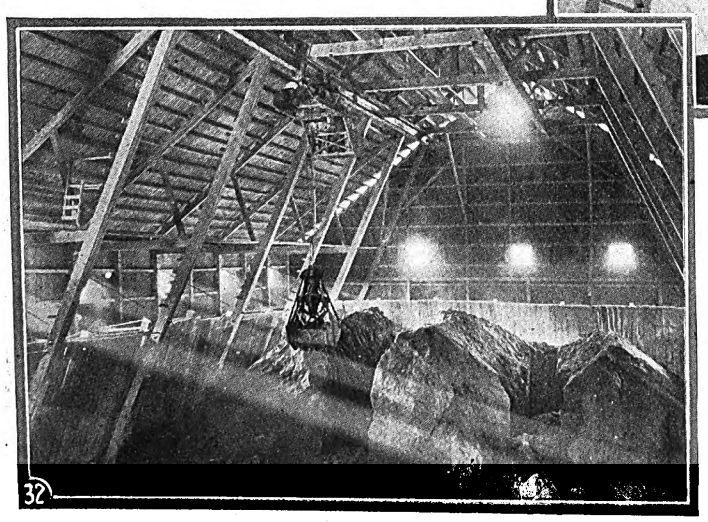
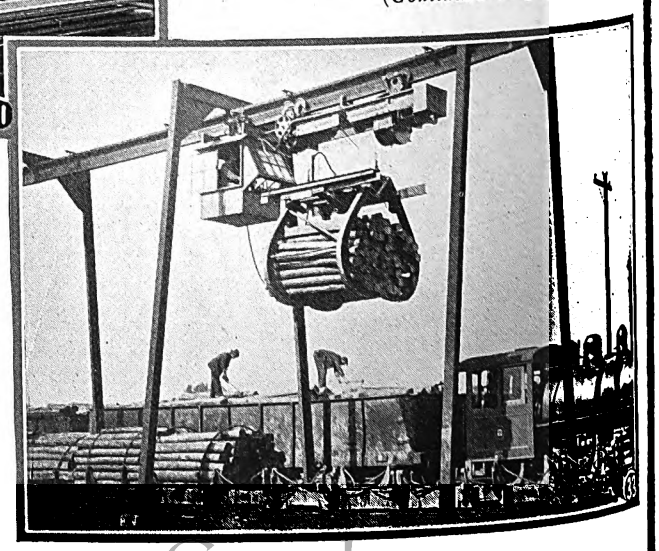
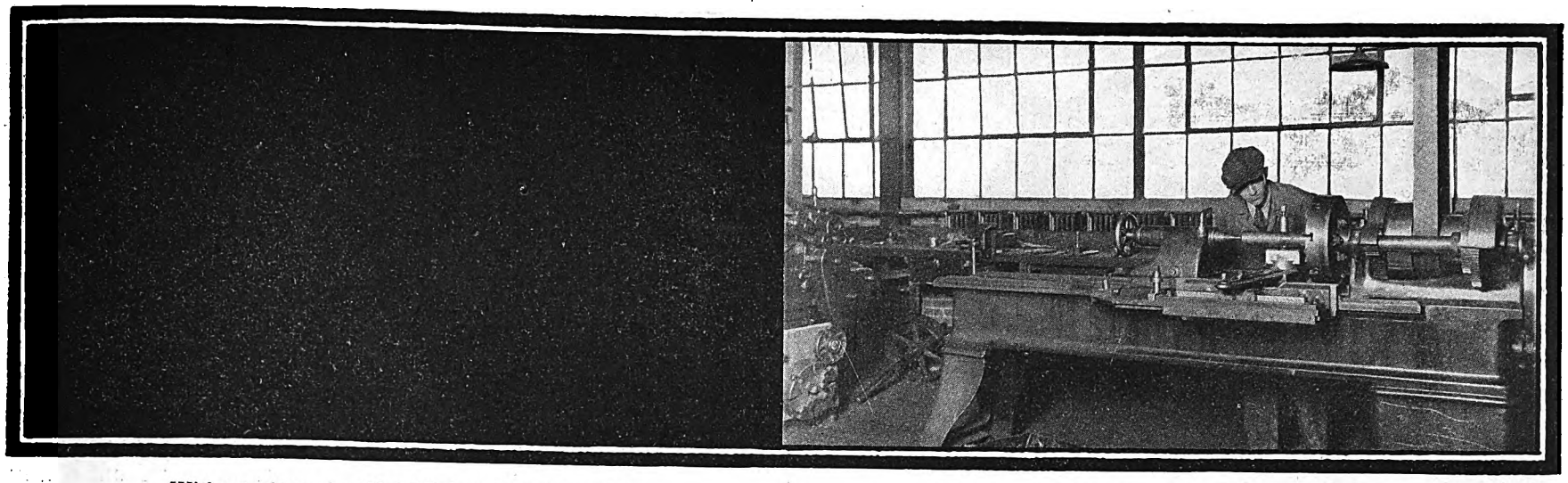


Fig. 33. The Michigan Wood Preserving Co., by installing a telpher-monorail system as shown, saved five men's wages on the tie handling operation. The grapple picks up unit piles of ties, transporting and placing same on special cars for creosoting, and is also used in the loading and unloading of cars.



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Without glass or artificial light a factory would be as pitch dark as a tunnel.

With plenty of clean glass the interior of the factory is flooded with perfect light.

Why Don't You Use Tin Where You Now Use Glass?

A RIDICULOUS question? Not at all. Of course, tin will not let in daylight. Neither will dirt, rust, and soot encrusted glass

You realize that to increase production, decrease spoilage and minimize accidents, proper illumination is vital.

But, are you enjoying the benefits of proper illumination? Does the only perfect light—Daylight—flood the interior of your plant?

Or does dirty glass bar out the daylight—keep your plant dark and gloomy—make necessary expensive light bills for artificial illumination?

The short, dark days of winter will soon be here. But like hundreds of other great manufacturing institutions, foundries, steel mills, etc., you can have a well daylighted, cheerful plant this winter. For it is easy—economical—highly profitable to clean the dirtiest ribbed glass with—

Skybryte CLEANER (LIQUID)

Skybryte liquid cleaner for ribbed glass dissolves and cuts the most stubborn crust of grease, rust, carbon scale, soot and dirt—practically instantly. Yet it is absolutely harmless to putty, paint and window sash.

Easy to use. An unskilled laborer dips a brush in Skybryte and coats the dirty glass. At once the hardened crust that was impregnable to other means of cleaning loosens. Then, flush off with water. The glass is clean. Daylight floods the interior of your plant.

Skybryte is inexpensive. Five gallons cleans 4,000 square feet of dirty ribbed glass. An unskilled laborer cleans 5,000 square feet per day. The average total cost of cleansing is less than ¾c. per square foot, including both labor and material.

Write for Trial Offer

Skybryte is guaranteed to win your prompt, enthusiastic approval. We are glad to prove it, entirely at our risk. Write for particulars of our trial offer. Also, concerns in your city using Skybryte. Please state approximate square footage of glass to clean.

THE SKYBRYTE CO.
KEITH BLDG., CLEVELAND, O.
Chicago Branch 20 E. Jackson Blvd.

FREE TO YOU

Thirty minutes with America's foremost light expert. An intensely interesting book brim full of valuable facts on proper illumination. Gladly sent on request.

To Better Serve America's Industries

The Skybryte Company after considerable research and experimental work has perfected these other products.

SKYBRYTE Cleaner (Powder)

For plain or polished glass. No water necessary. No dust. No muss. No scratching.

SKYCO NO-GLARE

A window coating that lets in all the light but eliminates the heat and glare.

SKYCO SASH PAINT

Costs more per gallon but less per job.

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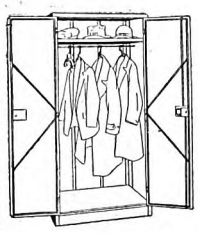




For books, records, advertising material, forms, supplies, this is the ideal storage cabinet. Keeps out dirt, dampness, vermin, rats and fire.

Storage for Anything

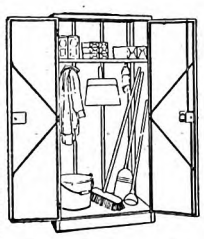
Everything costs so like the dickens—tools, dies, jigs, patterns, parts, etc., not to mention factory forms, stationery and miscellaneous supplies. And the waste, loss and spoilage of these expensive items runs into many dollars a year.



Inserting coat rod turns it into a handsome wardrobe accommodating six persons easily. Adds to the looks of any office.

How do *you* protect such materials from dust, dampness, fire, petty pilfering and carelessness? The Van Dorn All-Purpose Steel Storage Cabinet is mighty cheap insurance against such losses.

It is roomy—36 x 70¾ x 22½ inches inside. It is sturdy and well-made. Shelves are quickly adjustable. The door closes tight, and locks safely, top, middle and bottom. It is low enough in cost for the plant, and handsome enough for the front office.



By taking out some of the shelves, it makes a practical janitor's closet. Why not keep even these supplies in a neat and orderly manner—and safe!

While you think of it, see it at the Van Dorn dealer's or send for catalog—*and stop those leaks.*

THE VAN DORN IRON WORKS COMPANY

Mastercraftsmanship-in-Steel

CLEVELAND

Branches: Cleveland New York Chicago Philadelphia Washington Pittsburgh

Van Dorn

MASTER-CRAFTSMANSHIP IN STEEL

The Advertising Department and the House Organ

By Maxwell Droke

FOUR years ago I made a survey of internal or employee house organs in the United States. At the time I commented upon the fact that more than two-thirds of these publications that came under my observation were edited by the manufacturer's advertising department.

I have long been opposed to any policy which contemplates placing the responsibility of an internal house organ upon the shoulders of the advertising manager. It's not that I'm so solicitous about the welfare of the poor, overworked advertising manager, although goodness knows he usually has enough to keep his hands full without seeking new worlds to conquer.

No, I'm thinking of the worker's side of it. And I have taken my stand as a result of several years of first-hand experience and observation in the industrial field. As an advertising executive, I have edited a pretty fair factory magazine, as such publications go. Having a natural inclination for the work and some experience in the field, I devoted, perhaps, more time, effort and thought to the magazine than the average advertising man would expend on a similar publication.

And yet, looking back now, I can see that I was a failure—or, at best, only a near success. The workers read my magazine. They liked it. I rather think, too, that they liked me. And yet, somehow, I was never quite able to sell these folks *The Spirit of the House* exactly the way I wanted to. For one thing, I did not have the time. There simply were not enough hours in the day to enable me to do my regular work, to say nothing of this "side-line" as my superiors termed it. Another thing is that my position forced me to live in one world, while, in my editorial duties, I was endeavoring to make contact with a totally different world. It seldom works out well. Despite my efforts to "mix in" with the workers, the fact remained that I was a "front-office" man. I had a little cubby-hole with my name on the door, and a gum-gargling gazelle to "take" my letters. That let me out. Much as I might yearn to do so, I could never quite get the complete confidence of the time-clock punchers. I just wasn't in the right position to do it, that's all.

Nor was my position an unusual one. Many similar instances come to mind. I recall especially the case of an advertising manager of a large musical instrumnt house. The vice-president came to him one day a year or so ago with flattering words and a rough dummy of a proposed factory house organ. "Here, Jimmie," he said, "you take this thing and whip it into shape. You're the very chap to do it. You can sell anything with paper and ink—and we've certainly got a big idea to sell the workers. Gotta do away with all this friction in the factory and speed up production."

Well, "Jimmie" went to the mat with his superior officer. "I can't see your point at all," he declared frankly. "Just because I have demonstrated my ability to sell musical instruments to intelligent, upper-class Americans, I see no reason why it logically follows that I should be able to 'sell' an institution to its begrimed, illiterate laborers. I am perfectly frank to admit that I don't understand these people. I have no contact and no common interest with them. I can 'get you up a magazine' as you put it. That's simple enough. But I can't get you up *the* magazine you need. I'm not a snob, but I have sufficient common sense to convince me that this isn't my job. I'd never 'convert' those workers if you gave me a million years and ten days extra to do the job."

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And thus the battle raged for half a day. But in the end the advertising manager won his point, and the company employed a special editor to devote his entire time to the factory publication.

Where two or more manufacturers are gathered together in the faith, the chances are better than even that sooner or later the talk will drift to the Human Factor. The labor problem is the one problem that is never quite settled in any factory. Industrial unrest in greater or less degree, has come down to us through the ages since the first labor strike at the Tower of Babel.

Just now we are particularly concerned about labor turnover, and kindred problems. There is much talk of discontent, revolt and bolshevism in the ranks of labor. No clear-thinking American executive "takes stock" in the contention that this bolshevism will manifest itself in wholesale murder, sabotage and ruthlessness.

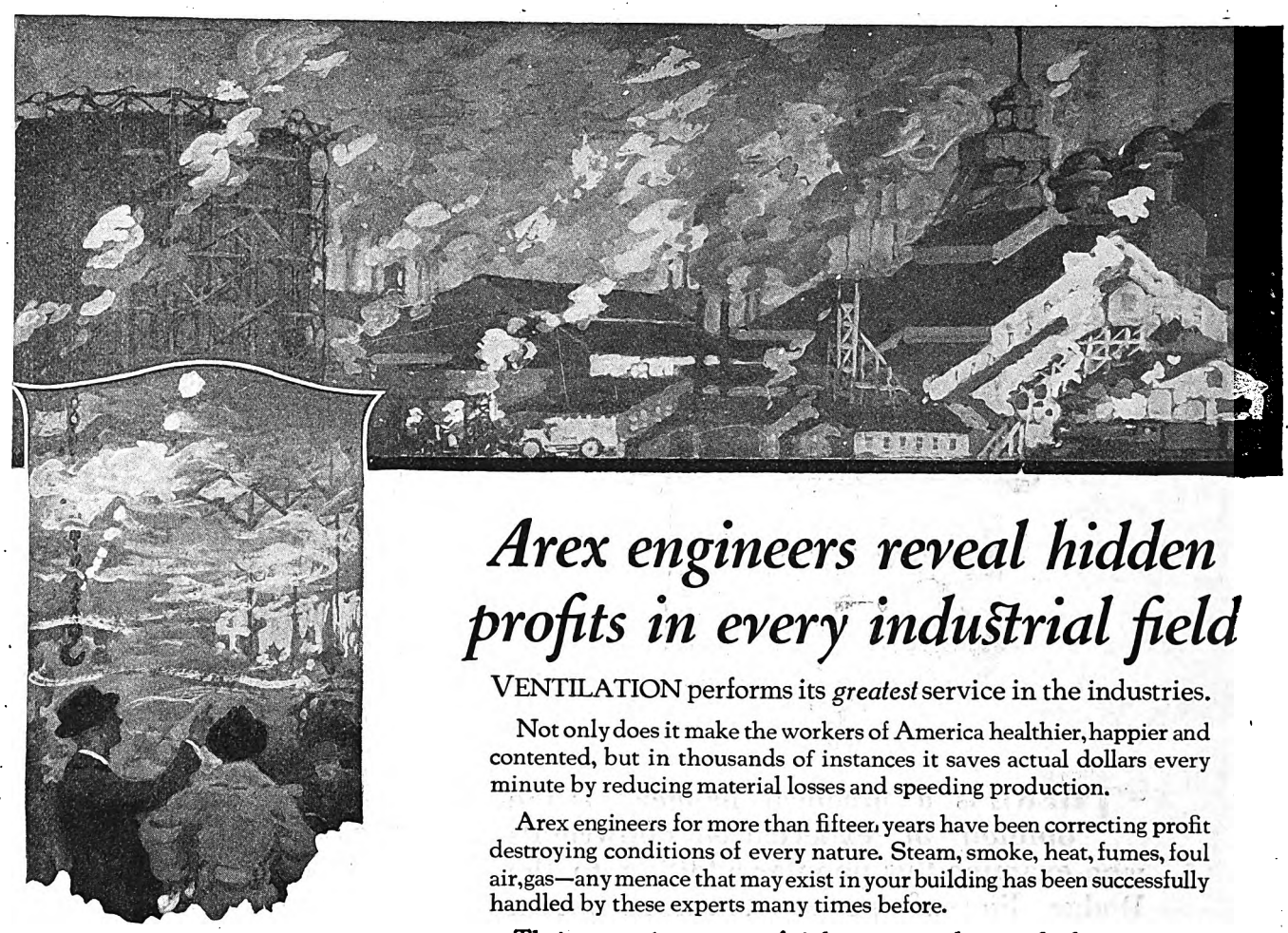
And yet we know full well that there *is* a bolshevism in America today. Not so radical, not so insidious, mayhap, as the "made-in-Russia" brand. But nevertheless it offers a deadly danger to industry. It is the bolshevism of "hands-without-the-heart" labor; the bolshevism of the man-turned machine; the automatic worker who has no abiding, deep-seated faith in the hand that signs his pay check, and who distrusts all things capitalistic.

That is the bolshevism we need fear in America. It is the bolshevism against which our industrial leaders wage unceasing battle. Its poisonous fangs can dig deep into the very heart of an organization, contaminating its life blood, and turning a living, breathing business into a ghastly, fleshless skeleton.

And there is only one way to eliminate it. This brand of bolshevism must be beaten down by a campaign of Understanding. This is the real mission—the outstanding task—of the internal house organ. Here is a job to which the best efforts of a powerful publication may well be consecrated. But if the factory magazine is to measure up to its responsibility *it must be properly edited!* It isn't a part-time job for the advertising manager, or a task to be blithely passed along to the president's nephew who "has a knack" for writing. No, sir! The factory magazine is too potentially important a publication to be carelessly disposed of in any such manner.

A number of years ago I predicted the coming of a new man in the realm of industry. A real internal house organ editor. I said that he would have to be a big man. A creator of the Family Spirit. A sort of industrial wizard, creating miracles with human chemicals—a man who could weld Capital, Labor and Management into a single unit, and make them see that they are all members of this lodge, in good standing.

Above all, our internal house organ editor should have the Understanding Spirit. He must be the literal heritor of those who saw the Angel bar the Garden Gate and heard his command "By the sweat of thy brow." A worker. A worker who has lived, and suffered, and learned the lessons



Arex engineers reveal hidden profits in every industrial field

VENTILATION performs its *greatest* service in the industries.

Not only does it make the workers of America healthier, happier and contented, but in thousands of instances it saves actual dollars every minute by reducing material losses and speeding production.

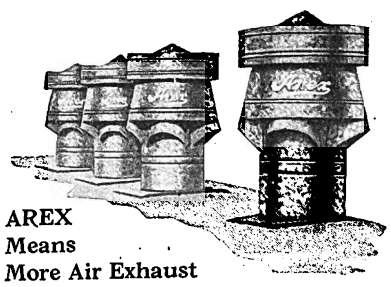
Arex engineers for more than fifteen years have been correcting profit destroying conditions of every nature. Steam, smoke, heat, fumes, foul air, gas—any menace that may exist in your building has been successfully handled by these experts many times before.

Their corrective system of siphonage ventilation which requires no power equipment is practical for a single room or an entire factory. The low first cost and expense of installation will surprise you—in many cases the savings effected balance them within a few months.

Put your problem before these engineers for consideration. The specification blank below will bring you a complete survey without cost or obligation. Attach rough sketch or blue print of building and address Arex Company, Engineering Division, 1583 Conway Building, Chicago.

World-known leaders in every branch of manufacturing are found on the list of Arex Installations:

Carnegie Steel Company
Packard Motor Company
Bethlehem Steel Company
American Steel & Wire Company
American Car Company
Ford Motor Company
Armour and Company
Standard Textile Products Company
Studebaker Corporation
Stewart Mfg. Corporation
Semet-Solvay Company
Cadillac Motor Company
Sinclair Refining Company
Corn Products Refining Company
Crane Company
International Harvester Company
Kelly-Springfield Tire Company
Sherwin-Williams Company
Whitney Glass Company
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Whiting Plover Paper Company
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AREX
Means
More Air Exhaust

AREX COMPANY
J. C. Kernchen, Pres.
INDUSTRIAL VENTILATING ENGINEERS

GET THIS 20-PAGE BOOKLET ON SIPHONIC VENTILATION

It contains a discussion of types of ventilators,—their applications for different kinds of work and buildings,—blue-print sketches for various roof structures,—exhaust capacities and dimensions of Arex Ventilators.



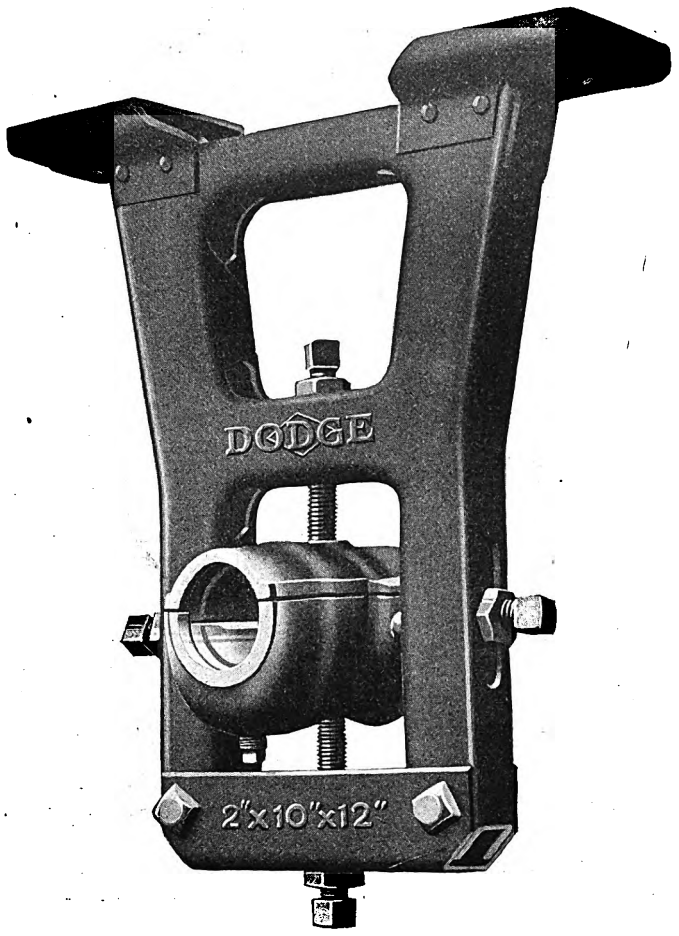
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AREX COMPANY, Conway Bldg., Chicago
Gentlemen:—
Please mail a copy of your booklet shown above to:—
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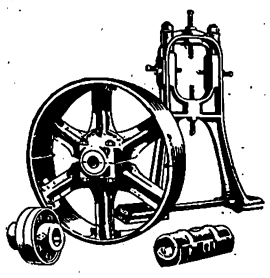
A Pressed Steel Hanger guaranteed by DODGE



"THERE is a practical hanger" is the opinion of experienced millwrights who examine this popular addition to the Dodge line of power transmission equipment.

It is light—strong—safe—easy to erect—unbreakable and low priced. Two years of careful experiment is embodied in its design and construction—it has withstood tests far more severe than any that will ever be encountered in regular line shaft service.

Dodge steel hangers are guaranteed by Dodge Quality which has been recognized for over forty years as an assurance of low first cost, low upkeep expense and continuous trouble-free performance.



Buy Dodge steel hangers as well as pulleys, clutches, couplings, collars, etc., from your local dealer on the immediate delivery basis.

DODGE

Power Transmission Machinery

DODGE MANUFACTURING CORPORATION

General Office: Mishawaka, Indiana; Works: Mishawaka, Ind., and Oneida, N. Y.

New York Boston Philadelphia Pittsburg Cincinnati Houston Chicago St. Louis Atlanta Minneapolis Seattle San Francisco Newark Oneida

of everyday existence. He must be a man who really *knows* how much $28.00 a week is, and how far it will go. And how long even an eight-hour day can be, if you have to sit stooped over a machine from morning till night. He must be a man who can see a host of tired, dirty workers flooding the open doors of the factory, as the evening whistle blows—and get a thrill out of the sight. Yes, that kind of a man.

I've done a deal of thinking about this new man—this modern Moses in industry. I have talked to industrial leaders about him. We have combined our visions and agreed upon certain well-defined fundamentals. As nearly as I can put it into words, the job that confronts the editor of a factory magazine today is to make the laborer see that his company is more—much more—than an embossed letterhead and a lithographed pay check. The workingman must be convinced that the company lives. And breathes. And thinks. *And is interested in the worker and the worker's welfare!*

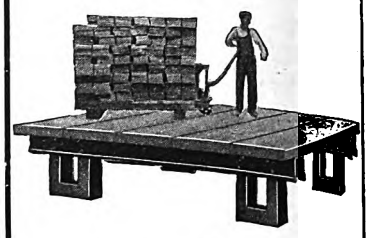
And now, I am beginning to see my Understanding Man step boldly forth and take his place in the ranks of industry. Rapidly he is becoming a reality. His number is limited. There are as yet far too few of these Understanding Men. But more—and still more—will come, as the need becomes apparent to a steadily increasing number of industrial executives.

This Understanding Man is to be a sort of super advertising manager—selling the company to the worker. But let us not forget this fundamental rule of advertising: The article to be exploited must stand the pitiless test of publicity. No matter how clever, and how earnest, the Understanding Man may be, he can do little permanent good for the manufacturer who does not wholeheartedly believe in and practice a square-deal, meet-the-worker-halfway policy.

Freight car loadings have reached new high levels. This extraordinary volume of railway traffic reflects not only the seasonal movement of crops, but the heavy production and purchasing of goods earlier in the year.—*The Guaranty Survey.*

Cost Less-Weigh Less and Live Longer

No weight except where weight is needed



From Drawing Board to "Nesting"

Lewis-Shepard Lift Truck Platforms are planned, designed and built with exacting eye for

MINIMUM WEIGHT

Moreover—the design of the Lewis-Shepard Lift Truck Platform insists on *all pressed steel,* scientifically folded and formed so as to *secure* this minimum weight and at the same time *insure* MAXIMUM strength.

Lewis-Shepard Lift Truck Platforms

(1) Weigh less
(2) Nest easier
(3) Fit any type of truck
(4) Live longer because they're stronger

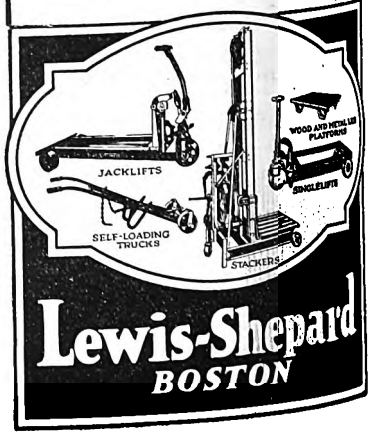
You need our special pamphlet on Lewis-Shepard Lift Truck Platforms

Order your copy Today
It's yours for the asking

LEWIS-SHEPARD CO.
582 E. FIRST STREET
BOSTON, MASS.

Branches in 22 Principal Cities

Canadian Fairbanks-Morse Co. Ltd.
"Distributors for Canada"



Lewis-Shepard BOSTON

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Can you find your business here?

Ammunition, Guns, etc.
Automobiles, (Motors and Bodies)
Auto Accessories
Auto Painting, etc.
Aluminum Wear
Bolts and Nuts
Brushes
Brass Goods
Candy Mfgrs.
Cans
Carpets and Oilcloths
Chemists
Chairs
Clothing
Colleges and Universities
Copper Goods
Contractors
Electrical Appliances and Supplies
Engines
Flour Mills
Foundries
Fountain Pens
Furnaces, Stoves, Ranges
Furniture
Garages
Golf
Hardware
Heating Apparatus
Inks
Japanese Goods
Jewelers, Silversmiths
Knitting Mills
Laces
Lamps
Lanterns
Leather
Lumber
Machinery, Iron and Sheet Metal Workers, etc.
Machine Shops
Metal Furniture
Mining
Dept. stores
Paper
Optical Goods
Pianos and Organs
Plumbers' Supplies
Power Houses
Private P.B.X.
Printers, Publishers, etc.
Produce
Pumps
Radio
Railroads and Supplies
Refrigerators
Rubber Mfgrs.
Roofing Supplies
Rolling Chairs
Scientific Instruments
Shade Rollers
Shirts and Collars
Shipbuilding
Sporting Goods
Shoes
Smokers' Articles
Soap
Steel and Wire, Wire Rope, etc.
Storage Warehouses
Stoves
Tailors
Textiles
Truck Deliveries
Undertakers' Supplies
Uniforms
Women's Wear
Woodworkers
X-Ray Equipment



THE leading firms in the industries listed above are using Calculagraphs to record *elapsed time.* The Calculagraph prints on the job ticket starting, stopping and *elapsed time.* If you would like to know more about the application of the Calculagraph to your own business write for our booklet "Elapsed Time Records."

THE CALCULAGRAPH
THE ELAPSED TIME RECORDER

34 Church Street, New York City

When writing advertisers please mention Industry Illustrated

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Two Ways of Heating—



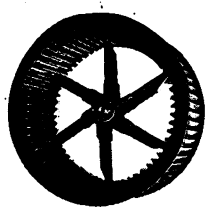
—and the better way costs no more

Heating by means of direct radiation is simply a process of warming dead, stuffy air—but heating by blowing heated fresh air into shops, factories and offices is heating and ventilating *combined.*

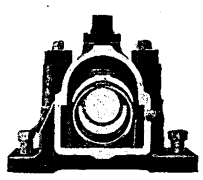
A Clarage heating and ventilating system is cheaper to install under ordinary conditions than a direct system which supplies heat alone—and often the operating cost is considerably lower. Moreover, an air washer and humidity control can be added, providing ideal air conditioning which invariably improves the health and efficiency of employees.

For a number of years, Clarage engineers have made an intensive study of ventilation. They know from experience the proper system and fan equipment for your plant. Ask them to either assist you directly or work with your engineer or architect.

The Clarage catalog No. 52 fully covers the subject of heating, ventilating and humidifying. Have you read it?

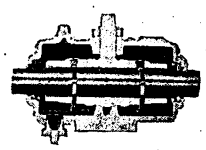


The famous Clarage Multiblade Fan Wheel. The blades are formed with dies, insuring absolute uniformity. The spider, in all larger sizes, consists of steel arms accurately cast into iron hubs. The Clarage Ring Oil Bearing.



The Clarage Ring Oil Bearing

It is adjustable in all planes, insuring correct alignment, and it is provided with felt washers to keep the oil in and dust out—an exclusive feature.



Where Ventilation Pays

Clarage fans are made for ventilating kitchens, exhausting fumes, gases, dust, for ventilating toilets, for supplying properly conditioned air necessary in manufacturing tobacco products and textiles. They are also widely used for pneumatic conveying, supplying draft to furnaces, cupolas, forges and countless similar uses. These applications are covered in a book, "Moving Air." Write for it.

Branches: In Principal Cities
Complete Stocks Carried at New York and Pittsburgh
Special Stocks at Memphis

CLARAGE
FAN COMPANY
FANS~BLOWERS~EXHAUSTERS
KALAMAZOO, MICH.

Clarage Fans are built in types and sizes for every service.

new piece of machinery in its place which was in due time installed. This delay, however, compelled the coal company to cease all operations for a period of 18 days, and to recover damages for the value of the machinery as well as for the loss of profits entailed by this shutdown, the instant action was instituted.

Upon the trial of the cause, the trial court directed a verdict in favor of the coal company for the value of the machinery, but declined to hold the express company liable for special damages alleged to have been caused by the forced shutting down of the coal company's plant for 18 days. From this judgment the coal company prosecuted an appeal to the higher court where the question of the correctness of the trial court's ruling, on the right of the coal company to special damages, was squarely in issue.

As the deciding of this question turned upon the construction to be given, the instructions notice and information the coal company had given the express company, at the time the machinery was delivered for shipment, the court directed its attention to this phase of the case, and in summing up the evidence on this point it was, among other things, said:

"The evidence of plaintiff's agent, Wallace, who delivered the piece of machinery at the station, is that he had no particular talk with the express agent at the time as to what was to be done with the machinery, but he did tell him he wanted it sent that evening, so it would get to Knoxville, and that witness was going to follow it the next morning and have it repaired; that he did not remember of having any discussion with the express agent as to whether the mine could operate without this machinery, but he told him he wanted it sent to Knoxville to be fixed, so that they might operate the mine on Monday. The express agent stated, in substance, that Wallace told him the mine could not run until the machinery was fixed and returned, and the statements of these two witnesses constitute the whole evidence of knowledge or notice upon the part of the express company or its agent . . ."

Following the above sum-

If we would save you 50% on the cost of the soap

used in your employees' wash rooms and would prove it to you, and at no expense to you whatsoever, it would interest you, wouldn't it?



Hang up your soap with a soap-holder

and you'll hang up a new record for low soap consumption.

To any user of our soap we will supply the fixtures free of charge as long as you use our soap, and we keep them in condition.

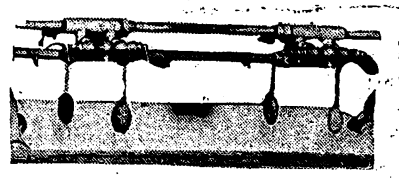
Free trial offer

We will send you fixtures to equip your washroom together with a sufficient amount of soap to give it a thorough tryout and remember it costs you nothing. Neither does it place you under any obligation to us whatsoever.

Cut washroom maintenance costs

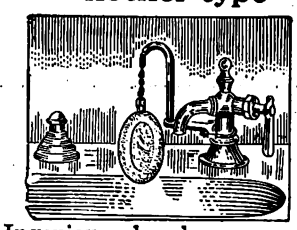
With the soap-holder—Soap cannot be carried away, thrown on floor, or left in water to become soft, mushy and unfit for use—it cannot break up when worn and clog drain or make the washstand untidy.

One of many types



These soap-holders are made in many different types and designs. They are made of brass, heavily nickel-plated, or of German silver and extra strong to resist tough usage.

Another type



Ingenious locks securely attach the soap to fixtures by means of an anchor imbedded in the bar of soap.
Where these fixtures are installed—every ounce of soap is used.

Write today for full details.

ANCHOR CORE ECONOMY SOAP CO.
136 West Lake Street, Chicago, Ill.

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ming up of the evidence, as to notice given the express company at the time of delivery of the machinery, the court turned to the question of whether or not this notice would justify the imposition of special damages upon the express company for the shutting down of the coal company's plant caused by the loss of the machinery. In reaching its conclusion upon this point the court, among other things, said:

"In this case the only notice given to the defendant was that the plant could not operate without this piece of machinery; but that does not necessarily imply that the plant would be operated, if that piece of machinery was not out of repair, or that its operation would not be stopped for some other reason. Nor does it imply that, even though it necessitated stopping the operation, loss of profits, or loss of any kind, would result therefrom. There is nothing in the evidence from which it may be inferred, either that knowledge was had or notice given that the plant was operating at a profit, or that it would operate, except for the condition of this piece of machinery * * *.

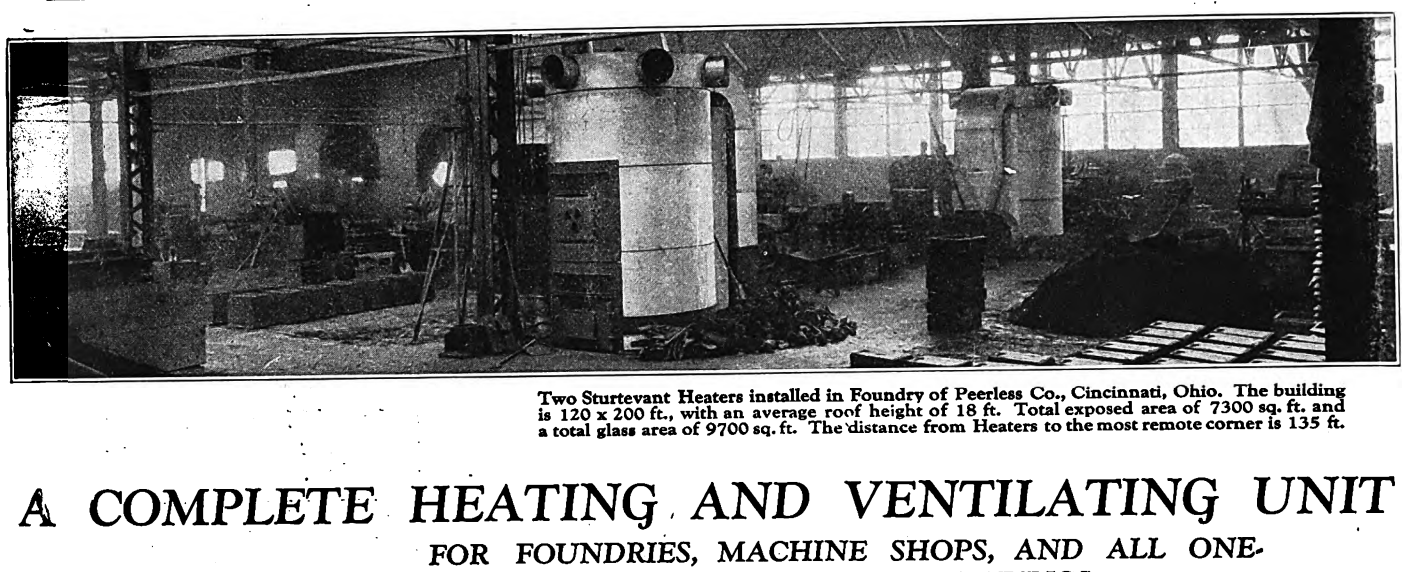
"To make such a notice of the special circumstances sufficient to authorize a recovery for special damages, there must be imparted to the carrier information of such facts as will bring home to it the peculiar facts and conditions known to the shipper that will entail upon him a loss not ordinarily within the contemplation of the parties, if the shipment is lost or its delivery delayed * * *.

"Justice and fair dealing require that, when you expect to recover from a carrier damages of this nature, which are not apparent upon the face of the transaction, such notice be given as will put the carrier on guard, and give it some idea of the additional responsiblity involved * * *.

"The knowledge of the agent as alleged being the same as the notice proven to have been given to him, and that notice not being sufficiently explicit as to the facts and circumstances to authorize the assessment of special damages, we think the action of the lower court was proper * * *."

In conclusion the higher court affirmed the judgment of the trial court, allowing the coal company damages for the cost of the piece of machinery lost, but denying it special damages for the alleged loss of profits because of the shutting down of the plant for eighteen days awaiting the installation of a new piece of necessary machinery.

It is obvious that the foregoing Kentucky decision is one of importance and value to industrial executives in general. It illustrates in a striking manner the importance of a clear explicit notice to the carrier of the facts and circumstances which will result in special damage to the shipper if a given shipment is lost or delayed, if the shipper intends to hold the carrier liable for such special damage. Truly then, this Kentucky decision is one of value on the point decided, and its holding may with profit be had in mind by every industrial executive, when delivering shipments to carriers of such importance that their loss or delay will result in special damages to his firm.



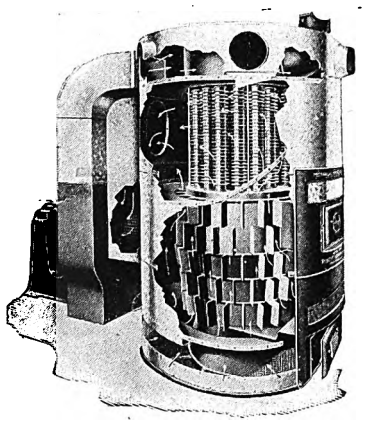
Two Sturtevant Heaters installed in Foundry of Peerless Co., Cincinnati, Ohio. The building is 120 x 200 ft., with an average roof height of 18 ft. Total exposed area of 7300 sq. ft. and a total glass area of 9700 sq. ft. The distance from Heaters to the most remote corner is 135 ft.

A COMPLETE HEATING AND VENTILATING UNIT

FOR FOUNDRIES, MACHINE SHOPS, AND ALL ONE-STORY INDUSTRIAL BUILDINGS

This great heater employs simple but radically different principles from other heaters. It forces warm air horizontally near the floor level in the direction needed. It puts warmth into every nook and corner.

Mechanical Hot-Blast Heater. Formerly manufactured by the Robert Gordon Co. Now built and sold exclusively by the B. F. Sturtevant Co., through their National Sales and Engineering Organization



1. Costs less to install than indirect heating systems and uses up to 50% less fuel.
2. Direct-fired. Burns economically either hard or soft coal, coke, oil, or gas.
3. Keeps the heat in circulation near the floor instead of allowing it to waste upward.
4. Ventilates. A Sturtevant Multivane Fan eliminates irritating fumes and steam. This is especially important in foundries.
5. Simple construction. Ordinary mechanic and helper can assemble it in a few hours.
6. Can be operated by anyone who can swing a shovel. Does not require the attention of a skilled engineer or boiler-man.
7. No steam or drip pipes to worry about. Nothing to freeze up.
8. Extended surface fins on the fire pot and the thin rings on the tubes provide a maximum heat-radiating surface.
9. Over-all efficiency is 81% by official test in the Laboratory of the Armour Institute of Technology. More than double that of any other type of heater.
10. Recommended for drying clay products, asbestos, magnesia, tobacco, cereals, vegetables, textiles, and all other products dried by warm air up to a temperature of 400°.

Shipment of these heaters can be made from stock if you act promptly. Call in one of our engineers and let him help you with your heating problems before the cold weather comes.

Send for Bulletin No. A306

B. F. STURTEVANT COMPANY, HYDE PARK, BOSTON, MASS.

Sales Engineering Offices:
Atlanta, Ga.
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Chicago, Ill.
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Divisional Factories
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PUTS AIR TO WORK

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Experience

By C. A. Turner

ONE is greeted on all sides today with pleas for high grade help, in fact, help of any kind may suffice. It may be possible that a certain aid may result if the present available timber is carefully worked over in the light of its real quality. Such quality may have two essential indicators from the production point of view, and many others from the sales or commercial point of view. These indicators may be considered to be, basically, education and experience. Of education the writer dares not to discourse publicly. Of experience his feelings are different, and therefore, this opportunity and medium is being taken advantage of.

In making statements of facts, as observed, maybe things are said blandly, but it is for the sole purpose of stimulating others to talk or write on this subject that this article is prepared.

There has been passed down through the years the saying, "Experience is the best teacher." This may be a paraphrased version of a more classical allusion, which has been much used, and probably much abused. But at the outset, is it not probable that "experiment" may have been the original initial word in this epigram? It is hoped that its real significance has been appreciated more often than otherwise. Nothing but harm can accrue from any superficial treatment or consideration of such an expression—"Experiment is the best teacher."

Briefly, the word "experience" is defined: "Knowledge derived from one's own action." This is satisfactory as a beginning. Is it really all that it purports to be? Every one will concede that he has had years of experience, but if this short, terse definition holds, we may justly wonder whether he really has. Could "Experiment" have been better used?

The technically trained university graduate upon the completion of his academic activities turns towards work. To encounter work he must run the gauntlet of some few interviews which may be something like the following:

Executive Employment Manager (in a low but audible tone, while holding application blank for a position): "You are a graduate of State College in Engineering?"

Graduate: "Yes, sir."

Executive: "What has been your practical experience?"

Graduate: "Have done many things" (here prospect recounts various lines of effort, ranging from dish-washing to managing a small business, and amplifying each in turn).

(*Continued on page* 39)



Partial View of the Service Stock Room of the Delco Light Company, Dayton, Ohio. Here 46 Tons of Lyon Standard Steel Shelving Are Used to Store Delco Light Products. In Addition 2,000 Lyon Standard Steel Lockers Have Been Installed in This Factory.

The Adaptability of Lyon Standard Steel Shelving

In the October issue of Industry Illustrated was shown an installation of Lyon Standard Steel Shelving for storing heavy castings.

Here is shown the same type of shelving used to store light articles that girls can easily carry.

In large factories throughout the country you will find Lyon Standard Steel Shelving used exclusively for simplifying the storing of many varieties of products.

This evidences the adaptability of Lyon Standard Steel Shelving to meet the stores requirements of any manufacturer—no matter how simple or complicated the stores system may be.

And it also evidences the high quality of Lyon Standard Steel Shelving. For the preference of leading business institutions can be achieved only after experience over a number of years.

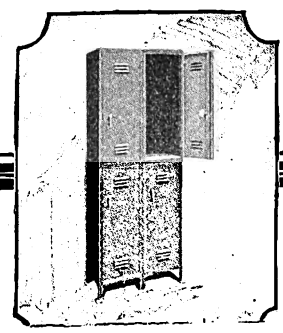
Perhaps our experience with the storage methods adopted by hundreds of large manufacturers may be of help to you. If so, it is offered gladly and at no cost to you. Simply write us direct or the division nearest you.

Lyon Metallic Manufacturing Company

Aurora, Illinois

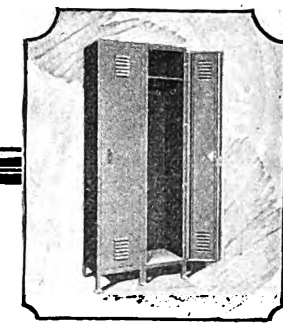
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LYON STEEL PRODUCTS

FOR EVERY STORAGE NEED



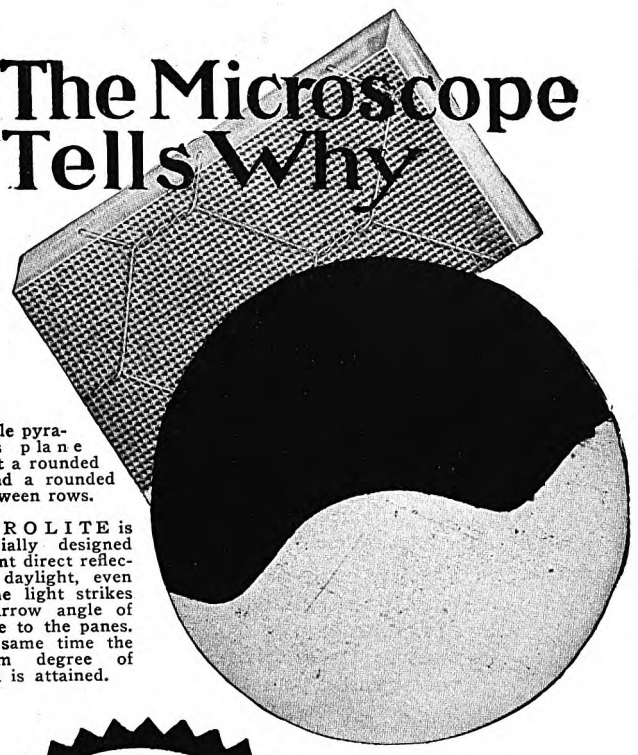
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Industry's Leaders are Believers in Daylight

The Microscope Tells Why



Each little pyramid has plane sides but a rounded apex, and a rounded fillet between rows.

FACTROLITE is scientificially designed to prevent direct reflection of daylight, even when the light strikes at a narrow angle of incidence to the panes. At the same time the maximum degree of diffusion is attained.

Here are a few of the many structures where better lighting prevails. Not by artificial light but by the use of daylight diffused through Mississippi Wire Glass.

"FACTROLITE" allows daylight to penetrate to all corners and permits employees to work facing the light. Glare is almost entirely eliminated and cost of plant maintenance is decreased to the minimum.

We recommend "FACTROLITE" for vertical openings, which gives perfect diffusion of the sun's rays, and "Pentecor" for skylights to give highest transmission and maximum illumination.

"FACTROLITE" eases eye strain on the workers nearest the glass and gives those in the building interior a clear shadowless light—ideal to work in.

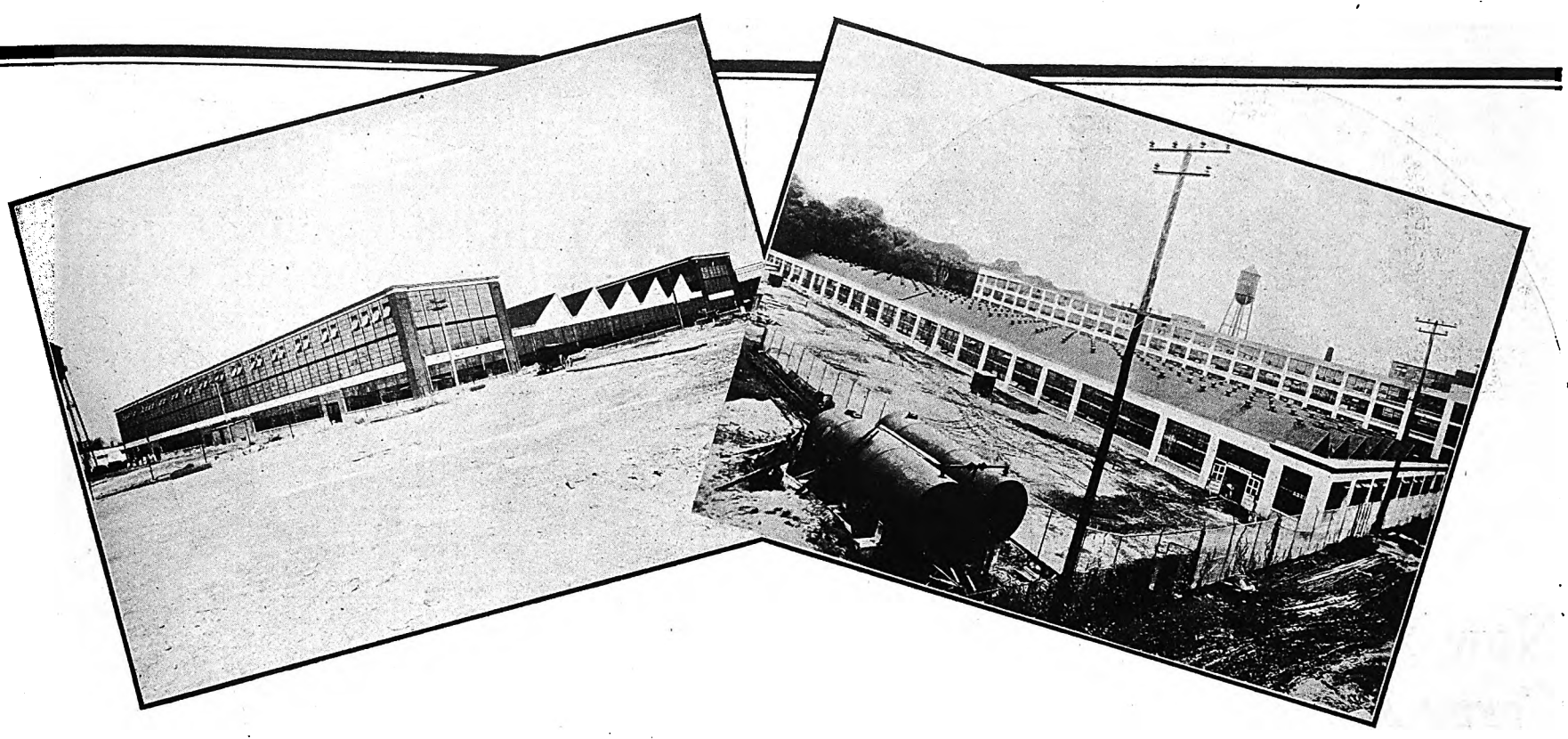
MISSISSIPPI - WIRE - GLASS - CO. WG FIRE RETARDANT No 32

Mississippi Wire

219 Fifth Ave,

Chicago, Ill.

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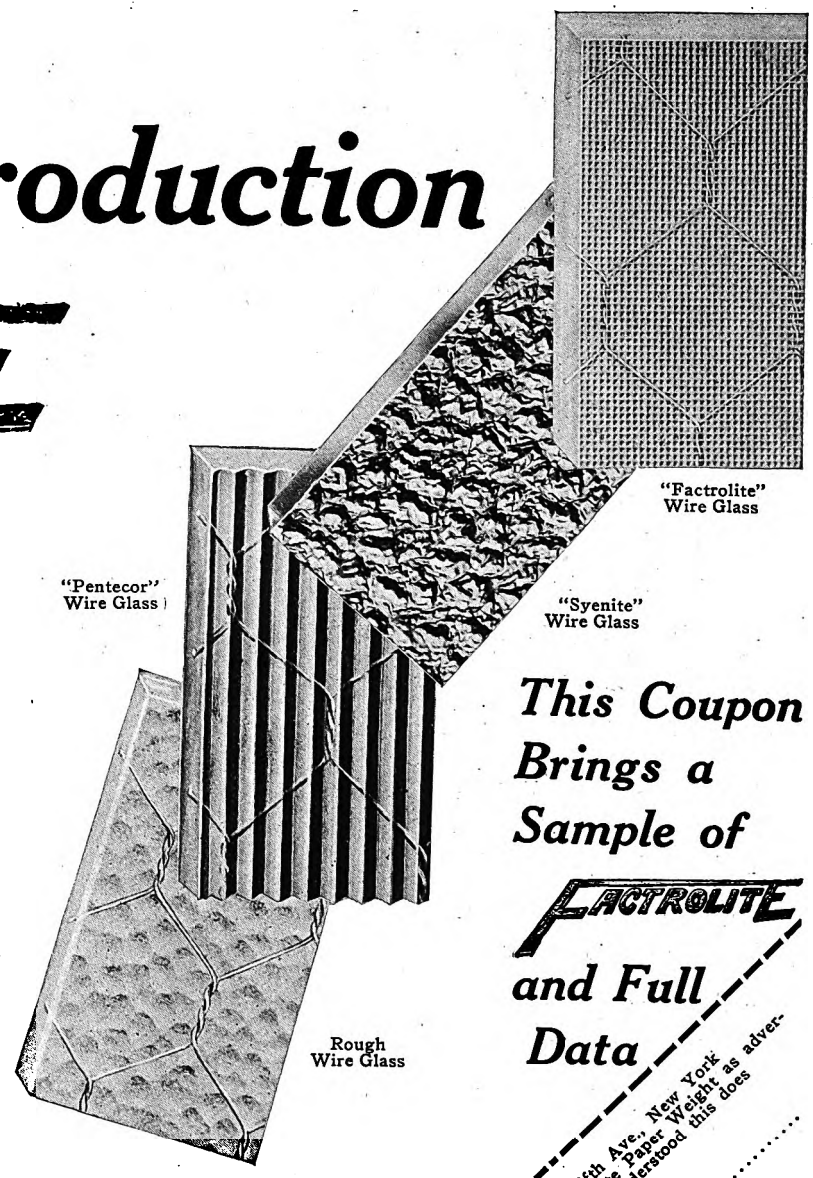
for Increased Production

with FACTROLITE

Note the clear light in the illustration showing an interior view. It is the utilization of daylight to the most efficient degree.

Mississippi Wire Glass in addition to aiding better production, minimizes fire risk and is the material upon which the underwriter's standard is based.

There are many types and designs to meet every industrial requirement for roofs, skylights, windows and other uses. Write for a sample.



This Coupon Brings a Sample of FACTROLITE and Full Data

Mississippi Wire Glass Co., 219 Fifth Ave., New York
Gentlemen: Send me a Catalog and Factrolite Paper Weight as advertised in Industry Illustrated. It is understood this does not obligate me in any way.

Name.....

Address.....

Glass Company

New York, N. Y.

St. Louis, Mo.

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The Mogul Type REELITE is furnished equipped with the ever-wearing, rubber covered Rome Super Service Cord. The conductors are protected and insulated by the heavy rubber covering without any loss of flexibility.

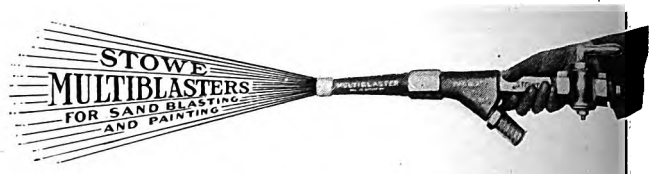
Now You Can Carry All the Current You Need—*Anywhere*

The Mogul Type **Reelite** has opened new opportunities for labor saving by portable machinery. Material handling apparatus whose scope was limited because of the difficulty of current supply has been given a new broad range—has been made to pay larger dividends on the original investment at only a negligible expenditure. ***Reelite*** prevents the loss of time and expense of kinked and knotted portable cords. It keeps them clean and ready, from under the wheels of trucks and heels of workmen—keeps production steady with no loss of time for cord repairs. The heavy, protected cord is acid, weather and wear proof—safe under all conditions.

Daily, people are finding old operations for the Mogul Type **Reelite** to modernize and make more profitable. It is furnished with 1″ male threaded hubs, and is readily adaptable to any machine. Let the Appleton engineers help you apply it to your needs —you will be under no obligation or expense.

APPLETON ELECTRIC COMPANY
General Offices and Factory
1716 Wellington Avenue • Chicago

MOGUL TYPE
Reelite
REG. U.S. PAT. OFF.



The Gun that brings down the cost of painting and cleaning.

STOWE MULTIBLASTER outfits offer you a better, faster and more economical means of painting and sand blasting. This method consists simply of mixing paint or sand with compressed air and applying it to the surface by means of an especially designed nozzle. It has been used with noteworthy success in a wide diversity of industries.

The labor and time saved by the MULTIBLASTER may be gauged by the fact that one outfit will replace 6 hand workers on metal surfaces, and 18 to 30 men on wooden or concrete surfaces.

The MULTIBLASTER does a better job with less sand or paint. Positive and uniform distribution is assured by the fact that the paint is drawn into the spray by suction, keeping the ingredients stirred up. There is much less paint wasted as compared with the brush method.

MULTIBLASTERS require no tanks. Sand is syphoned from pit, barrel or pile—paint from any container.

There are several thousand MULTIBLASTERS in use, all sold subject to trial, and paid for.

	Price	Weight lbs.	Hose Suction In.	Pressure lbs.
Standard Size Sand Blast	$30.00	8	1	80-90
Medium Size Sand Blast	18.00	6	¾	60-70
Bench Blast	15.00	3	½	40-50
Paint Spray	12.00	2	½	40-50



"The Man Behind the Gun"
(COPYRIGHTED)

Prove its value before you pay for it. Any outfit shipped for 10 days' trial, via express or parcel post, ready for instant attachment to your air lines.

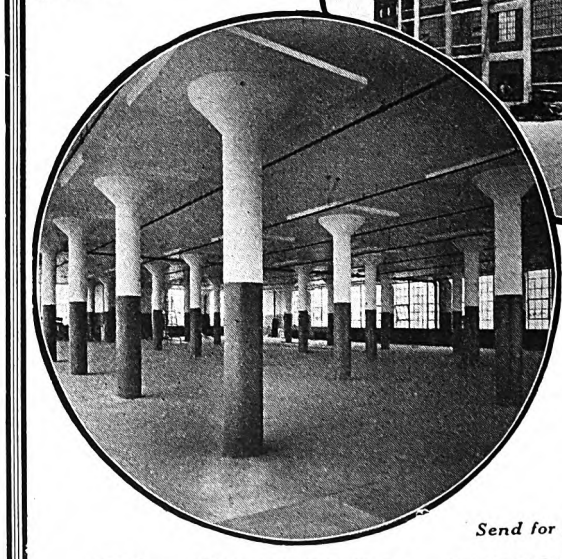
Geo. M. Stowe, Jr. Manufacturer
68 Forest Ave., Buffalo, New York

Do You Need a Specialist?

When you are sick you just naturally look up the specialist for the complaint. Do you see the point? We are the specialists for your building troubles—troublesome jobs are the kinds we specialize in.

Anybody can build a simple job but when special or complicated, it takes a specialist



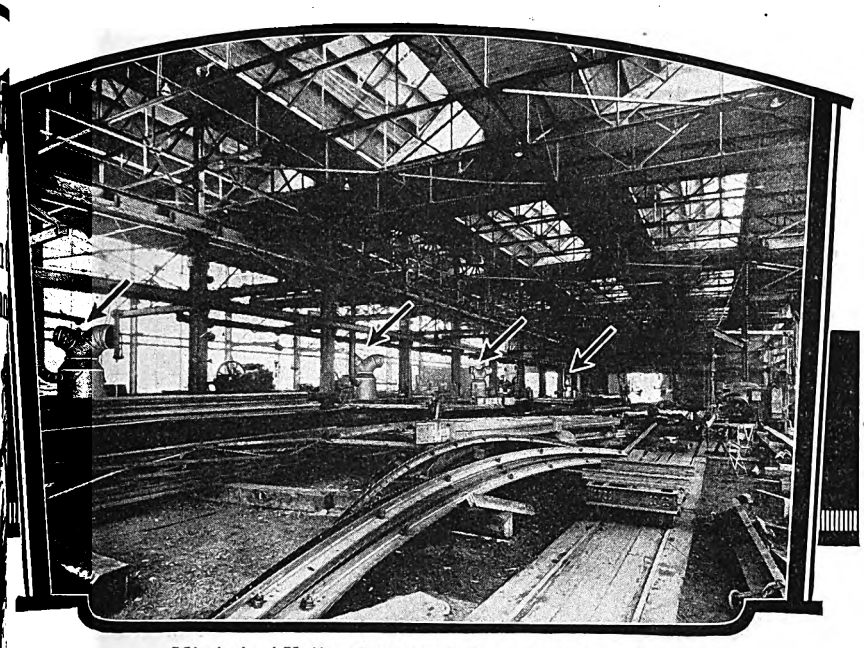


In the present day of high cost of labor, it will pay you to get in touch with our Service, where standardization and waste elimination will show you a substantial saving of both time and money.

Send for Booklet and Testimonials

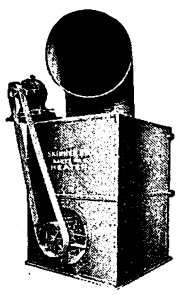
***The* BELING~BUSH CO., INC.**
FACTORY ENGINEERS AND BUILDERS
Drexel Building Philadelphia Pa.

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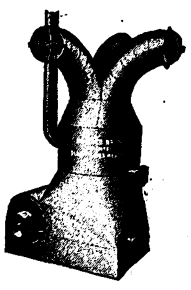
Mississippi Valley Structural Steel Co. plant, an extremely hard building to heat. Only 4 Skinner Bros. Type DF Heaters required.

Remarkable Performance of These Heaters Astonishes Engineers and Executives



Steam Coil Type SC

Utilizes live or exhaust steam at any pressure. Portable—can be installed by any mechanic.



Direct Fired Type DF

Where steam is not available. Burns coal, coke, gas or oil.

JUST think of this! During the very coldest weather Skinner Bros. (Baetz Patent) Heaters will keep any steel-sash and glass building comfortably warm at all times—even if the heaters *are operated only three or four hours daily*. This type of building is notoriously hard to heat—probably the hardest of any—yet Skinner Bros. (Baetz Patent) Heaters are operating successfully in scores of buildings of this class, to say nothing of numerous others.

The remarkable performance of these heaters has been a source of amazement to engineers and executives—at first it seemed impossible that they could do what was claimed. But, after the most rigid investigation in hundreds of cases, these heaters were chosen above every other type.

Performance of Skinner Bros. (Baetz Patent) Heaters is guaranteed, when installed as directed by our Engineers. Find out more about them! They are revolutionary in design—pioneers of their type—use no outside pipes or ducts—are strictly portable. Ask us for Catalog D-9 and list of users. Make your own investigation.

Also a Ventilator

Due to a fundamentally different design Skinner Bros. (Baetz Patent) Heaters are excellent ventilators, either when used for this purpose alone or in conjunction with heating. Useful both winter and summer.

SKINNER BROS. MANUFACTURING CO., INC.

Main Office and Factory: 1474 South Vandeventer Avenue, St. Louis, Mo.

Eastern Office and Factory: 140 Bayway, Elizabeth, N. J.

Boston, 445 Little Bldg. Buffalo, 702 Morgan Bldg. Chicago, 1703 Fischer Bldg. Cleveland, 612 Marshall Bldg.
Cincinnati, 1050 Hulbert St. Oliver Schlemmer Co. Wash., D. C. 714 Evans Bldg. U. D. Seltzer Phila., Pa., 1711 Sansom St. Haynes Selling Co.
New York, 1702 Flatiron Bldg. Pittsburgh, 8 Wood St. Pittsburgh Heating Co. Spokane, 409 First Ave. H. B. DeLong Co. Detroit, 308 Scherer Bldg.

Skinner Bros.
Baetz Patent HEATING SYSTEM

(*Continued from page* 35)

Executive: "Sorry, such experience may be helpful in other lines of work, but, you see, ours is a highly specialized concern, etc."—ad infinitum. Then, hesitatingly, "Well, we could employ you, but the salary will be 'X' dollars per month, and then after you have had some experience, we will put you in at a regular job. Take this letter to Smith and he will fix you up."

In the interim, it has been explained to the embryo engineer that his alma mater is held in high esteem by his new employer, and that there may be a great future in the game when his experience has become broader.

To many a college man, this kind of an induction into the business world does not stimulate his enthusiasm, but realizing his value as a producer, he is content with the wage, but—bring on the experience.

It may happen that this "cub" is placed to work under some older man, one who has been on the job a long time, years to the cub's days. Such older men are probably not academically trained, but they are on the job because of previous experience. Such previous experience is often acquired through learning the job under rule of thumb methods. Often this is essentially just running the job, or letting the job run them, or the job runs them in spite of their supervision. Should anyone dare to challenge the qualifications of such foremen they would be disposed of by the powers that be with dispatch.

If our technically trained man has benefited through his schooling, he has had a certain mental development, in spite of his fund of knowledge. This mental training has sharpened his ability to observe, remember, and think to a usable degree. The practical experience so necessary, can be taken in either of two ways.

He can work upon this so-called practical experience as an amplification or leavening of his academic training, and, as such, it will tend to round out his college work. In which event, each day's work will teach its own lesson, not so much a lesson as to how a thing may be done, or is done, in accordance with prescribed plant

Pounding Plibrico into place, to give a uniform jointless lining.



Here 91.4% of B.H.P. is Plibrico equipped

Richmond

PERHAPS nothing so clearly shows the wide use of Plibrico Furnace Lining as a survey recently made of the power plants in the hustling city of Richmond, Indiana. Here it was found that of the 54 boiler plants, 48 used Plibrico—a percentage of over 91.4 in rated boiler horsepower.

The reason for such extensive use, which is typical of the trend throughout the county? It's because Plibrico's long life makes it the most economical lining that can be installed.

Plibrico has no joints. In consequence, it resists the attack of the flame far longer than fire brick. Two, three and even four year service without relining is not out of the ordinary.

Don't you want the big book, "Refractories and Furnace Design" that tells how Plibrico gives long service and in addition cuts down heat loss through the setting? Send the coupon for your copy.

Plibrico is stocked in warehouses in over 60 cities in the United States and Canada, ready for immediate delivery or shipment.

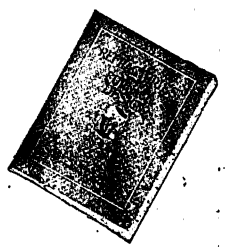
Plibrico is delivered only in steel containers of distinctive appearance as shown below.

PLIBRICO FURNACE LINING

JOINTLESS FIRE BRICK CO.
1154 CLAY ST., CHICAGO

This big book is FREE

Coupon brings it



Jointless Fire Brick Co., 1154 Clay St., Chicago.

Please send me the 32 page booklet "Refractories and Furnace Design"—no obligation.

Firm .....

Address .....

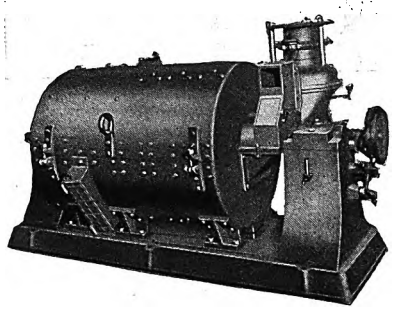
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Pulverized Coal



The Aero Unit System

of Pulverized Coal again demonstrates, as in other work of human endeavor, how an original idea at first worked out by complicated and costly methods is finally simplified and perfected until it becomes a part of our every day existence.

The Unit System reduces the equipment and therefore the cost to a minimum by placing the Aero Pulverizer at the furnace where the coal is fed to the machine undried and is exhausted therefrom directly into the furnace. There are no dryers, no storage or long lines of transportation for the powdered coal, thus eliminating the hazard of fire or explosion.

Each Aero Pulverizer is designed as a complete powdered fuel unit for one furnace. They are built in standard sizes ranging from 600 lbs. to 5000 lbs. of coal per hour.

Bulletin Sent on Request

AERO PULVERIZER COMPANY

165 Broadway
New York

practices, but why it is done, and done in such a prescribed fashion. To learn the fundamental features of the work does not require years of training, for the newcomer must, of necessity, advance provided his mechanical proficiency has kept pace with his mental activity.

On the other hand, the *why's* of plant practices may not occur to him, or he may accept them without question. His mechanical proficiency may develop after being taught the "ins" and "outs" but unless he has developed his gift-of-gab, his progress will be slow.

Under the proper observations, the man in the former situation further sharpens his wits, that is to say, his faculties of observation, memory and ratiocination have strengthened. Inasmuch as there is a continued demand for thinkers at the top, such a man progresses. However, in the latter situation, although there is developed mechanical skill and precision, the mentality is not stimulated. And lacking stimuli, possibly under such experience, the mental faculties, however keen initially, become dulled and in the course of time, must necessarily atrophy. Under this condition, a man soon loses ambition, contents himself with being a worker, having a job. He may be satisfied, until his college mates pass him on the ladder of progress and then, maybe, he inventories himself and finds a cure for his failure to make headway.

Contrast, if you will, some men who have had years of practical experience in running a job, and who because of faithful service rendered are promoted and sometimes placed in the executive offices with other men who have a marked degree of intelligence, yet not so many years of experience. Very often the man of practical experience does not respond to the situation, because, or maybe, in spite of his years of practical experience. Such years being years of service, have developed his hands and not his brain. The result is that such men first become elated on promotion and then discouraged, with a feeling that they are having a joke played on them by the management. Yet, in a carefully controlled organization, such occurrences are and

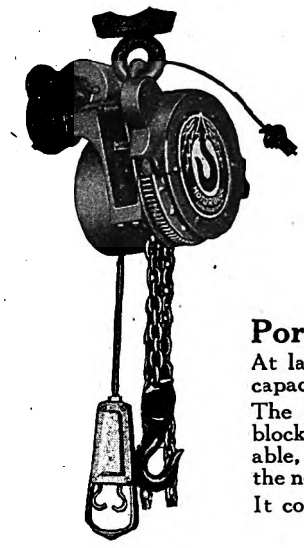
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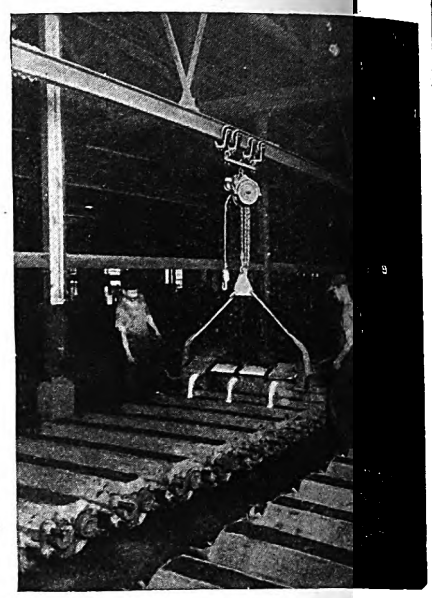
MOTORBLOC

THE *MOTOR-DRIVEN* CHAIN HOIST

SAVES Time Labor and Money
in many foundries

Isn't there a possibility that the **Motorbloc** *can do the same in your plant,—regardless of your line of business? Write us.*





Portable and Mechanically Right

At last,—a real portable electric hoist. The one ton capacity hoist weighs only 140 lbs.

The **Motorbloc** is hung up like an ordinary hand block in any location where electric current is available, and is put into service by simply plugging into the nearest socket.

It consumes less than 10c. worth of current per day.

Write for Bulletin S-101

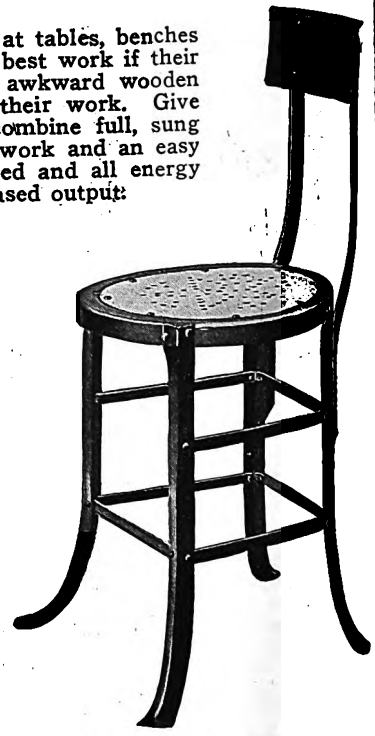
MOTORBLOC CORP.

Summerdale, Philadelphia
New York Boston Pittsburgh Chicago

Chairs *Do* Make A Difference In Output

Men and women who sit all day at tables, benches and machines—can they do their best work if their bodies are tense and tired from awkward wooden chairs? Such fatigue slows up their work. Give them comfort with chairs that combine full, sung back support, height to suit the work and an easy rest for the feet. Fatigue is saved and all energy used for work. The result—increased output.

METAL MEECO PRODUCTS



COSTS ARE LESS—

With all these advantages Meeco Steel Chairs cost you less than two cents per day per dozen with our five year guarantee. Could you buy good wooden chairs and keep them repaired five years for that price? The investment is an economy from the start. Get the new illustrated catalog. You'll find the Meeco Steel Comfort Chair will make better workers on your factory jobs. It means an increase in output you never realized.

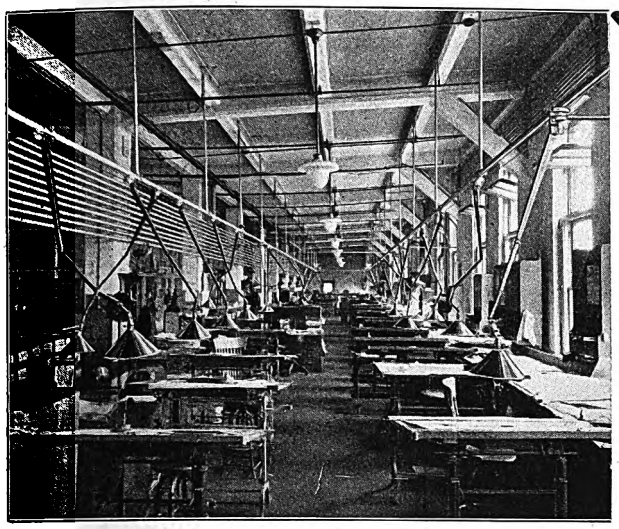
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Manufacturing Equipment & Engineering Co.

Factory and General Offices

Framingham Mass.

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6 STYLES
Ceiling Fixtures
Wall Brackets
Floor Fixtures
Bench Fixtures
Machine Fixtures
Portables

There are over 500 "American" Fixtures in the Drafting Rooms of the Allis-Chalmers Mfg. Co. at Milwaukee, Wis., of the type shown above.

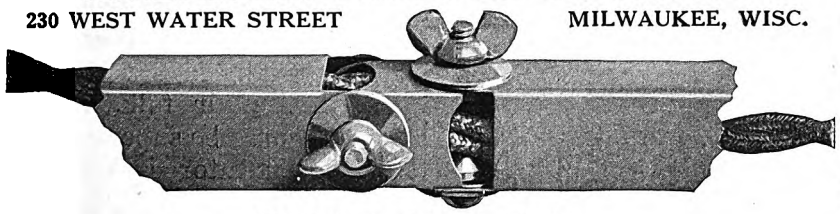
Boosting Production

That is the big thing that "American" Adjustable Fixtures accomplish when installed in your machine shop or factory. They bring the light to the work and enable higher intensities at low cost.

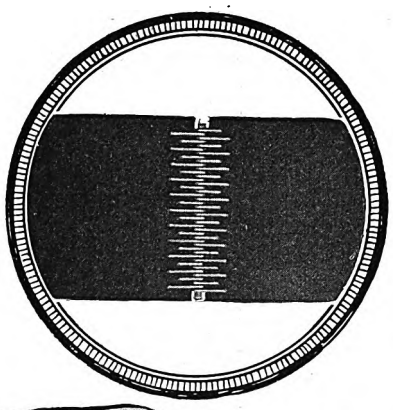
Its construction is very substantial. All conductor wires are enclosed in the fixture arms. The universal joints enable the operator to place its light in any position—and its stays put.

AMERICAN FIXTURE COMPANY

230 WEST WATER STREET MILWAUKEE, WISC.



Write today for Catalogue and prices





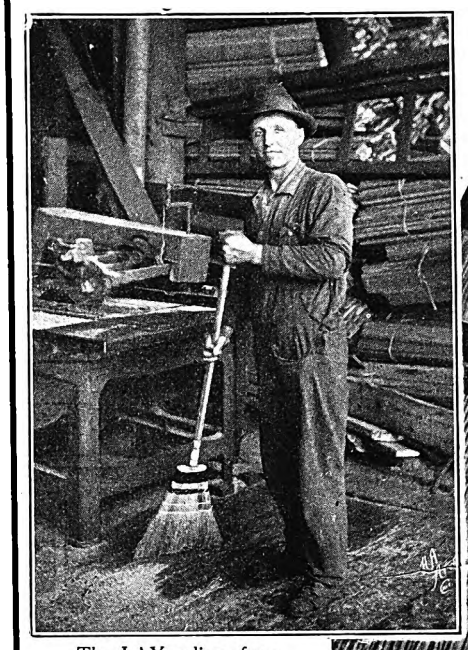
Because
DETROIT BELT LACING

is assembled with Rubberized Paper Side Strips, it stands handling any number of times without displacing a hook and cuts to any length with no waste whatsoever.

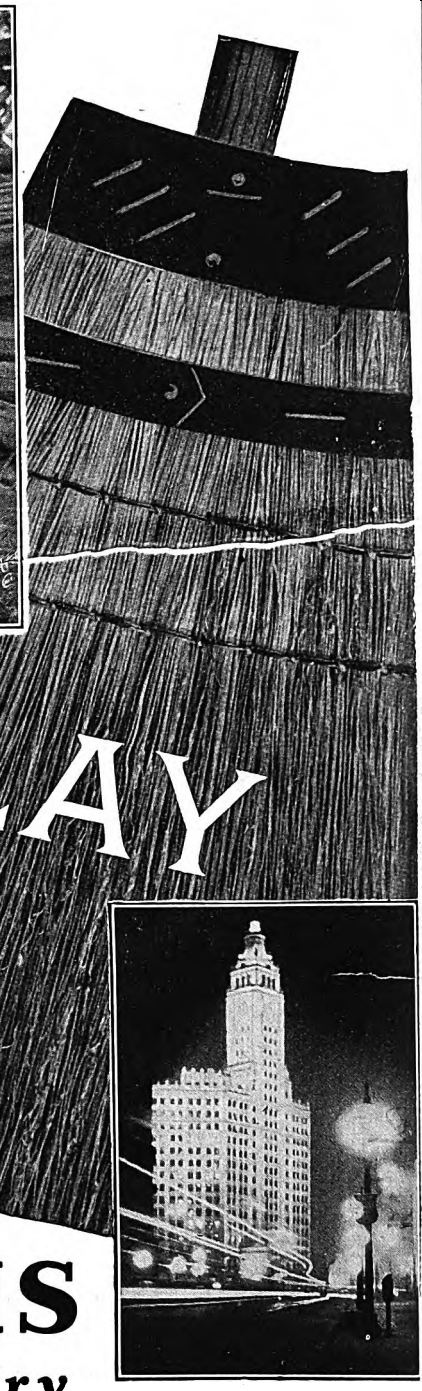
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Detroit Belt Lacer Company
Detroit, Michigan, U. S. A.

Branch Offices in Large Cities Licensees in Foreign Countries



The LAY policy of specialization in the manufacture of metal case brooms, inaugurated back in the seventies, provides for a special type of broom for each kind of factory. From wood-working shops to big constructing jobs, there's a LAY broom designed to do the job best and longest.



LAY BROOMS
—the primary tools of maintenance

Without doubt, the first cliff-dwelling stone carver must have had his bundle of twigs or branches—his broom—standing beside the entrance to his cave, ready to clean out the chips and debris accumulated from his day's work. Throughout the ages the broom has been the primary instrument of maintenance in home and factory alike.

Individual brooms do not cost very much, but when bought in gross lots several times a year, they represent quite an item. Because of the high grade materials used in their manufacture, the constant inspection of quality during construction, and the policy of building a different kind of broom for each kind of industrial sweeping, LAY brooms will last twice as long as an ordinary variety. They will

Cut Maintenance Costs in this item 50%

Besides, each one is fully guaranteed.

Order your Winter supply now. Price list on request.

Originators of the METAL CASE BROOM

THE JOSEPH LAY COMPANY
120 College Street

RIDGEVILLE INDIANA

Remember, we make a full line of brushes for every industrial purpose.

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must necessarily be a minimum.

It often happens that two men of the same general make-up start out together in a commercial organization, and after a few years find themselves far apart. In so far as mentality is concerned, the writer's observations are that the daily experiments of the one who advanced, taught him lessons from which he either consciously or unconsciously deduced certain fundamentals and placed them away for his future guidance. On the other hand, the fellow who was left at the post, failed to recognize a lesson in any of his daily experiments, and therefore, did not learn as did his co-worker. Now this latter man might have developed a "good line of talk" that would have disclosed to his superiors the feeling that he was a real go-getter, and then the conditions might have been reversed. Such lines of talk don't bear close scrutiny, and are generally superficial. Men of such experience as in the latter instance, hold their jobs by virtue of a long term of service, and possibly at some opportune time have made a hit with some one or more of the bosses through an accidentally staged grandstand play. This being the age of reaching conclusions through a very few—the fewer the better—observations, such a man is thrown into that class of good men from which future bosses are to be picked.

Let us return to our embryo engineer: Few of his employers recognize that his schooling has given him something on which to build, a foundation, that only a few of the untutored get after many years of work, and, therefore, after a period of training in a new line of work, at least enough to develop his necessary knowledge, he is really an asset. As such his remuneration and responsibility must be increased. It might be said that a young man may not have good judgment, but if his judgment is to be guided by facts versus opinion, and plain talk, his judgment should be superior to that of the untutored—with some exceptions. Yet, for such jobs which require judgment, wherein facts cannot be presented either in substantiation or otherwise, the utmost care should be used, and due allowance made for academic training.

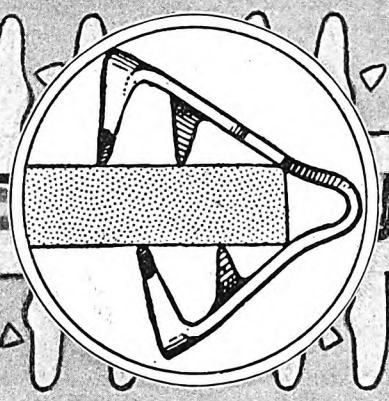
It seems that in the employment of new men, too much stress is unwittingly laid on experience, and not enough on intellect. The U. S. Civil Service appreciates this to some extent, when it allows four years' university work to be the equivalent of a certain amount of practical experience, but not very much. Many other employers realize that there is an advantage, but none have dared to publicly equate it. There are many men whose college training has been zero in the net, but the discussion of this is not within the scope of this article. The supposition is that if a man has had so and so much experience, he is very likely qualified for a job, and if the employer is not one who expects intelligent supervision on the part of his new man, such a man "gets by." In coming in contact with many men, it has been noticed that very often there would be two men on a job, one

(Continued on page 47)

ALLIGATOR

TRADE MARK REG. U. S. PAT. OFFICE

STEEL BELT LACING



How Lacing Can Lengthen The Service of Your Belts

The extra strength of ALLIGATOR STEEL BELT LACING means longer uninterrupted service. The teeth clinch through the belt end, compressing it in a grip of steel. It gives the weakest spot in the belt the greatest protection. The joint is flexible and separable. It is smooth on both sides and no thicker than the belt. Any good workman can make a long-lasting, efficient joint quickly and easily.

Standardize Your Lacing

Save extra time spent in lacing and replacing belts. Help them to give the maximum service which the manufacturers intended. Standardize your plant on ALLIGATOR STEEL BELT LACING for light and heavy duty drives.

Recommended by leading manufacturers of belting and by transmission engineers

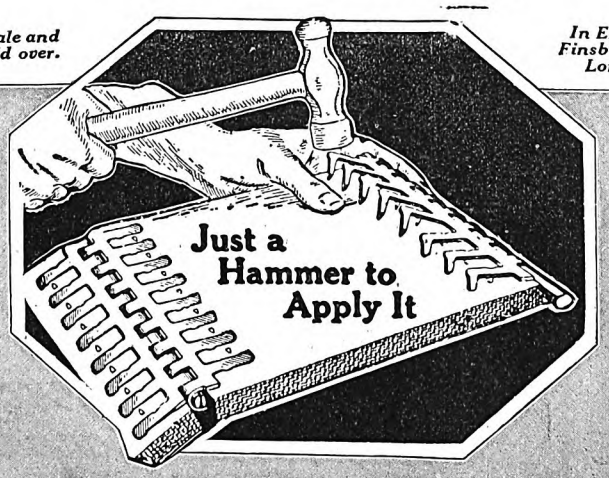
FLEXIBLE STEEL LACING CO.

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Sold at wholesale and retail the world over.

In England at 135 Finsbury Pavement, London, E. C. 2

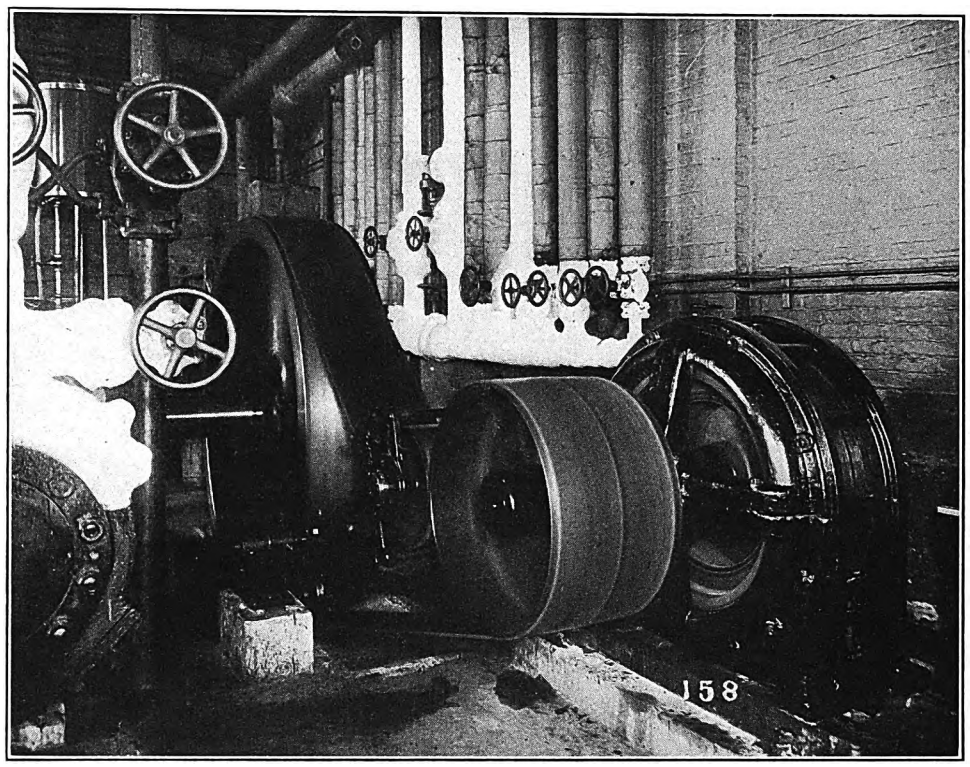
"Every Tooth A Vise"



For Every Size and Kind of Belt

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THE LENIX DRIVE



Point Number Four—Reduced Bearing Pressure

FIVE POINTS

1—The Lenix increases the arc of contact between belt and pulley.

2—The Lenix maintains constantly and accurately the proper tension in the slack side of the belt.

3—The Lenix saves floor space, building space and belting because of freedom in pulley locations.

4—The Lenix saves in bearing friction, lubrication and renewal of bearings because of reduced bearing pressure.

5—The Lenix permits the use of less expensive, high speed and high efficiency motors or generators because of the higher pulley ratios.

The reduced bearing pressure afforded by the Lenix offers tangible savings to the users of belt drives.

In open belt drives, except those liberally proportioned as to belt width and pulley centers, it is necessary to have an "initial tension" in the belt sufficient to transmit the load without slippage. This "initial tension" means that there is an unproductive, increased bearing pressure with consequent excessive friction losses of long duration, or the loss of a burned out bearing or motor.

With the Lenix drive, the belt is installed, without "initial tension," with sufficient slack to permit the Lenix roller to "wrap" it well around the smaller pulley of the drive—See illustration. When the drive is started, the Lenix exerts just enough pressure to prevent slippage.

The resultant bearing pressures are considerably reduced and there is less friction—Saving lubrication and power.

This point is forcibly brought to the attention in the installation illustrated of a 200 HP. two-bearing type motor driving an ammonia compressor. With the Lenix, two-bearing motors of much greater horsepower may be successfully operated where three-bearing motors with open drives would be essential. The saving in first cost of motors is obvious.

The Lenix is not an idler. It is a "belt wrapper" scientifically applied to belt drives for the purpose of eliminating belt slippage and increasing the efficiency of the drive.

Booklet: "Saving Slippage and Space"—contains interesting data on belt drives. Send for a copy.

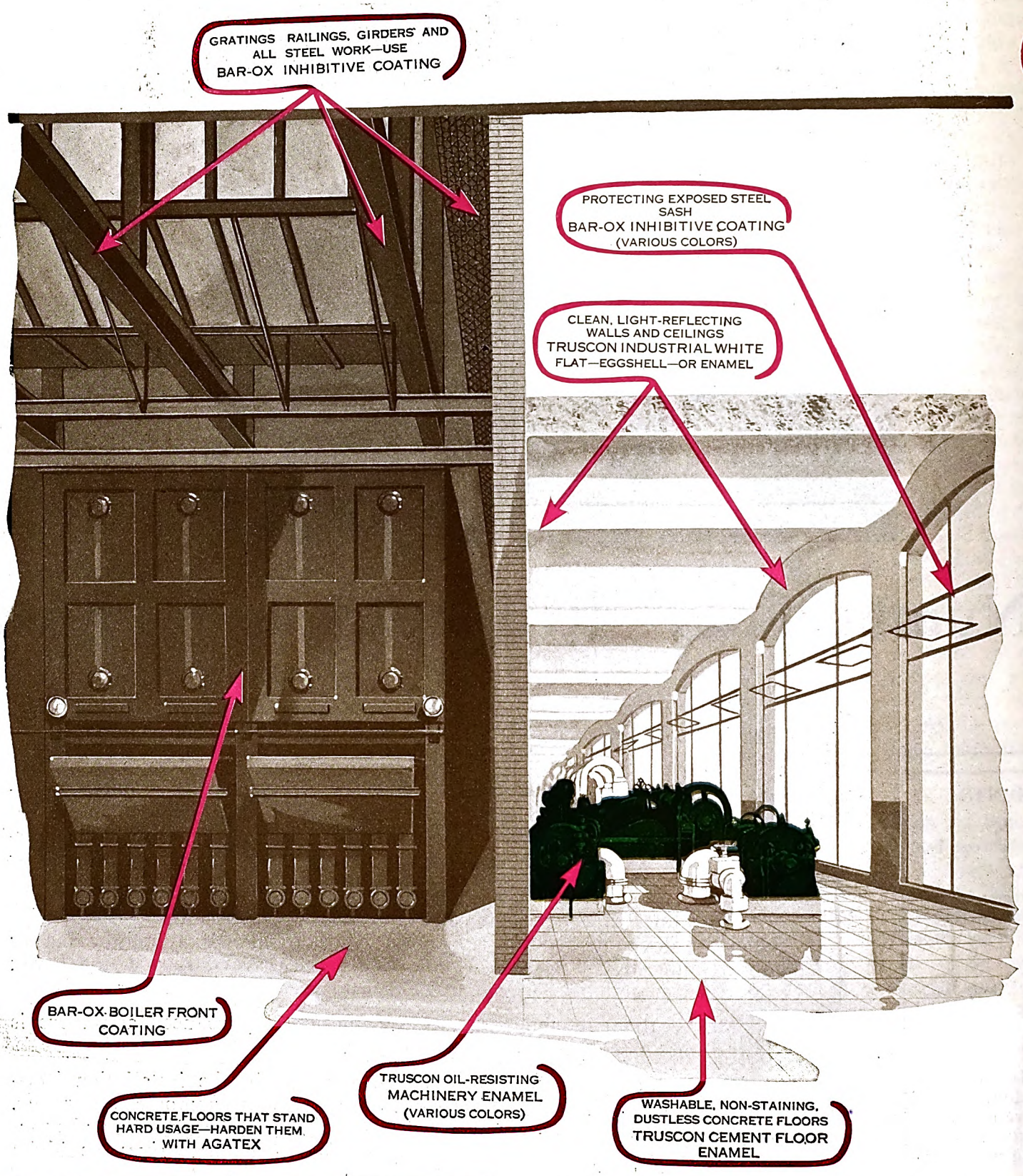
F. L. SMIDTH & CO.

ENGINEERS

50 Church Street **New York, N. Y.**

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TRUSCON MAINTENANCE ENGINEERING SERVICE

is a great help to Maintenance men, Works Managers and Building Superintendents. Whether it is protection against acid fumes that is desired, or a non-yellowing mill white—a concrete floor hardener or a waterproof structural steel paint—there is a Truscon Maintenance Product for every Maintenance Purpose.

—And a Truscon Maintenance Engineer capable of serving you and willing to help you.

Your inquiries are solicited.

SAVE THIS MA

Said the Superintendent of a large manufacturing plant—"A Truscon list of products reads like an encyclopaedia of Building Maintenance."

It does: we have been prescribing for maintenance requirements for many years. In that time we have developed a staff of experts specializing in Maintenance who know the subject thoroughly and can give straight-from-the-shoulder advice. Hundreds of Factory Superintendents and Maintenance Engineers today use this Service regularly. They recognize the merit of Truscon products, the value of Truscon recommendations, and the standing and financial responsibility of the enormous Truscon Organization back of these.

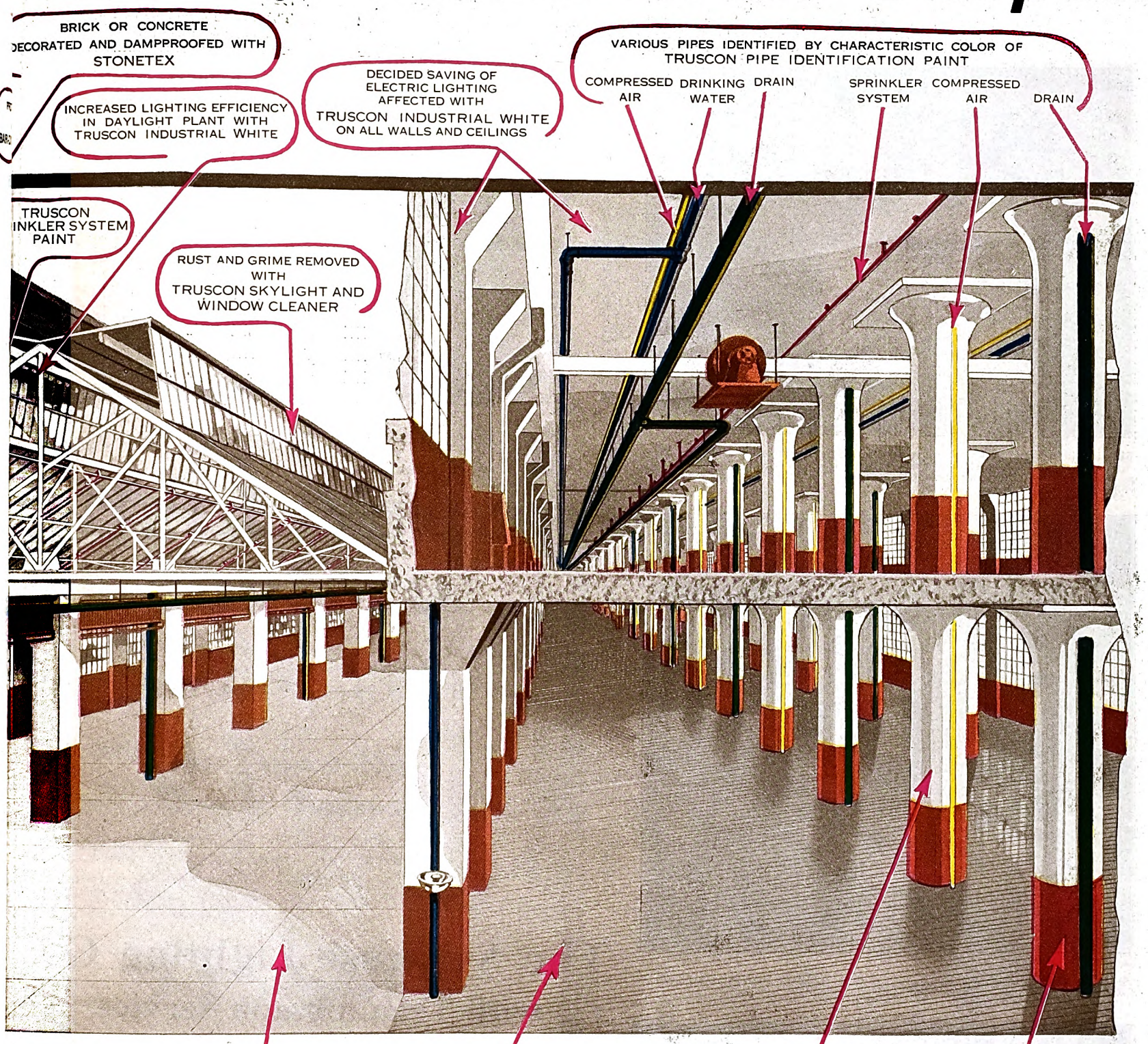
In order to visual tenance Engineering trated," we reprint Chart. Note the in this chart, all of and efficiency of pl that you save the

Truscon Maintenan out cost or obligati question you may w ing, waterproofing, affecting maintenanc ment—we will be pl

THE TRUSCON LABORAT

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...r Every Maintenance Purpose"



...NANCE CHART

...e of Truscon Main-...l of "Industry Illus-...uscon Maintenance ...irements suggested ...adding to the value ... We would suggest ...ence.

...rvice is yours with-...ed to use it. Any ...g painting, varnish-...any other problem ...of plant and equip-... you.

On the card opposite are enumerated some of the more common maintenance requirements of large buildings. If any of these fit your case, check, tear out the card and mail to us. Or, in the case of problems not mentioned on the card, write a letter describing same in detail. From our fund of experience we may be able to be of great help to you, and can assure you that we will tell you frankly what to do to take care of the situation.

Again we say—Without Cost or Obligation—and hope we may hear from you

Home Office and Factory—DETROIT, MICH.

BRANCHES—New York, Chicago, Philadelphia, Atlanta and 24 other principal cities.

USE THIS COUPON

for Further Information on Truscon Maintenance Service

No Obligation

- ☐ Steel Paint
- ☐ Concrete Paint
- ☐ Paint for Wet Surfaces
- ☐ Acid Resistant Paint
- ☐ Mill White Paint
- ☐ White Paint for Dye Plants
- ☐ Pipe Identification Paint
- ☐ Skylight & Window Cleaner
- ☐ Machinery Enamel
- ☐ Concrete Floor Hardener
- ☐ Wood Floor Preservative
- ☐ Enamel for Concrete Floors
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- ☐ White Paint for Rubber Plants

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Fig. 1.—Showing interpreter at office taking application for service from foreign born resident, who cannot speak English, and transmitting same on Telautograph to Credit and Shop Departments. These instruments are shown mounted upon a temporary counter while moving office to new location.



Fig. 2.—Showing employees, examining records to clear credit on applications taken as shown in Cut 1, which records on instruments both at main office and shop.



Fig. 3.—Showing operator at shop making up orders transmitted by Telautograph after credit has been passed. There is also shown on the right telephone order table at which applications for gas and electric service, complaints and leaks are taken.

RECORD OF SHOP ORDERS

Transmitted by the Telautograph January 8, 1923, to show time between actua receipt of order and execution of same. This does not include leak and miscellaneous orders received by telephone at shop.

Telauto-graph Nos.	Nature of Order	TIME: Application made by Consumer	TIME: Credit Passed	TIME: Further Credit Investi-gation	TIME: Order Given to Bill Jones	TIME: Bill Jones Arrived at Premises	TIME: Elapsed Between Taking of Appl. and Arrival of Bill Jones Hr.	TIME: Elapsed Between Taking of Appl. and Arrival of Bill Jones Min.	REMARKS
"A"	Machine								
1	Spl. Test	8.49	....	....	....	....	..	..	To be done 1- 9-23 Bookkeeper only
2	G	9.20	9.21	....	....	....	..	..	
3	G	9.47	9.48	9.57	11.08	11.15	1	28	
4	Canceled								
5	Sales	10.00	10.39	....	12.00	1.35	3	35	Welsbach heater
6	E	10.14	10.15	....	12.00	1.00	2	46	
7	PS	10.17	....	....	11.21	1.35	3	18	CGI
8	Set G&E	10.18	10.19	....	12.00	5.05	6	47	
9	SG&E	10.19	....	....	12.00	....	..	..	To be done 1-15-23
10	Void								
11	G&E	10.25	10.26	....	....	....	..	..	To be done 1-20-23
12	ST	10.30	....	....	....	....	..	..	To be done 1- 9-23
13	G&E	11.00	11.01	....	12.00	1.30	2	30	
14	Spec. Elect.								
15	E	11.15	11.16	....	....	....	..	..	To be done 2-20-23
16	PS	11.18	....	....	12.00	1.50	2	32	
17	Complaint	11.20	....	....	12.00	4.00	4	40	
18	PS	11.20	....	....	12.00	5.20	6	00	
19	ST	11.21	....	....	....	....	..	..	To be done 1- 9-23
20	ST	11.38	....	....	....	....	..	..	To be done 1- 9-23
21	G&E	11.37	....	....	11.40	....	..	..	To be done 1-10-23
22	G&E	11.40	11.41	....	12.00	1.45	2	05	
23	SG&E	11.42	....	....	....	....	..	..	To be done 1-10-23
24	SG&E	11.45	....	....	12.00	3.00	3	15	
25	G&E	12.02	12.03	....	12.10	2.05	2	03	
26	Spec. Elect.								
27	Set G	12.19	12.30	....	2.42	4.00	3	41	
28	Set G	12.30	12.31	....	12.40	4.20	4	00	CGI
29	G&E	12.34	12.35	....	2.42	2.50	2	16	
30	PS	12.40	....	....	6.15	8.15	7	35	Wrong address
31	PS	12.40	....	....	3.00	3.40	3	00	
32	AR	12.45	....	....	....	....	..	..	To be done 1- 9-23
33	AR	12.47	....	....	12.50	3.20	2	33	
34	PS	12.48	....	....	....	....	..	..	To be done 1- 9-23
35	SG	12.50	....	....	2.42	....	..	..	To be done 1-15-23
36	G&E	12.56	12.56	....	....	....	..	..	To be done 1-10-23
37	ST	1.00	....	....	....	....	..	..	To be done 1- 9-23
38	Leak	1.40	....	....	1.50	2.30	..	50	
39	AR	1.46	....	....	....	....	..	..	To be done 1- 9-23
40	G&E	1.53	1.54	2.06	....	....	..	..	Bookkeeper only
41	G&E	2.06	2.07	....	3.27	4.15	2	09	
42	Spec. Elect.								
43	G	2.46	2.47	....	4.14	5.00	2	14	
44	PS	2.50	....	....	3.48	5.20	2	30	
45	ST	5.10	....	....	....	....	..	..	To be done 1- 9-23
46	ST	5.11	....	....	....	....	..	..	To be done 1- 9-23
"B"	Machine								
1	SG	8.35	....	....	9.25	9.30	..	55	
2	PS	9.03	....	....	10.03	1.25	4	22	
3	G&E	9.09	9.10	....	10.23	8.30	..	..	Picked up by Bill Jones before disp'd
4	SG&E	9.10	....	....	10.23	9.30	..	20	
5	SG&E	9.25	....	....	9.55	10.30	1	05	
6	G&E	9.39	9.40	....	10.30	10.45	1	06	
7	SG&E	9.50	....	....	....	....	..	..	To be done 1-15-23
8	PS	10.00	....	....	....	....	..	..	To be done 1- 9-23
9	SE	10.24	....	....	11.10	11.20	..	56	
10	Void								
11	SG&E	10.40	....	....	....	....	..	..	To be done 1-15-23
12	Spec. Elect.								
13	G&E	10.48	10.49	....	12.10	2.30	3	42	
14	Leak	10.52	....	....	10.55	....	..	..	St. leak—Ref'd to Street Dept. 1 p.m.
15	SG	10.58	....	....	12.00	2.45	3	47	CGI

The Syracuse Lighting Co.

with Telautograph Service

Reduced the time on completed operations from two days to two hours and forty-eight minutes!

Rapid and accurate transmission **of orders is the secret of this Revolution in handling Shop Orders and Operation!**

Your Production can be speeded up by this fast Transmission of Reports. Just ask us about it—no obligation—ever.

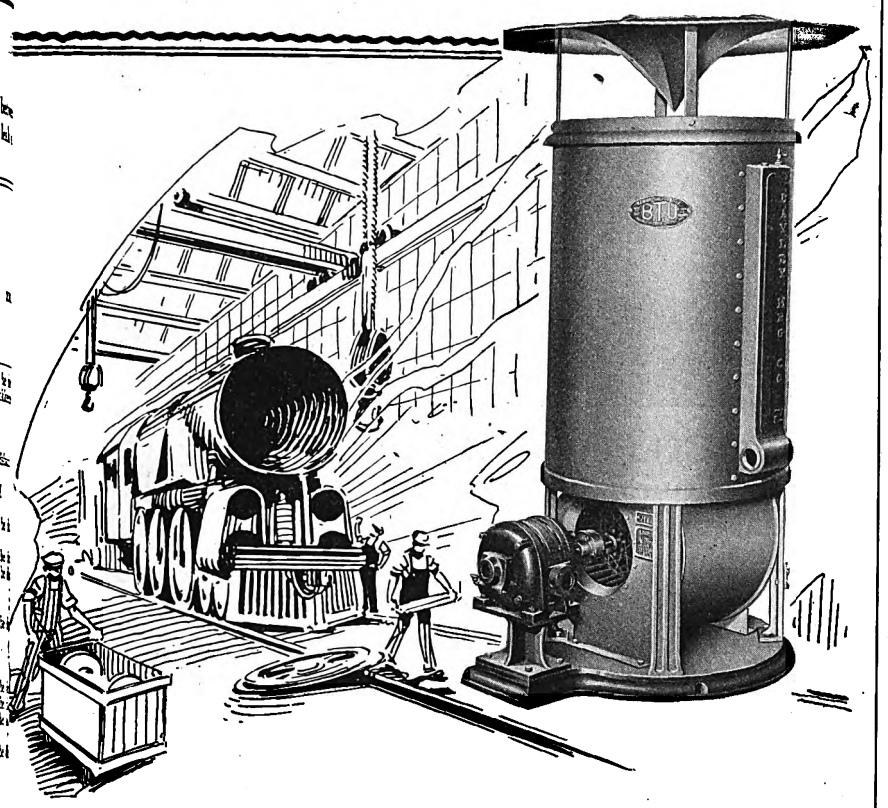
We will send our booklet—or our man.

TELAUTOGRAPH CORPORATION

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Heat Your Factory

Evenly, Economically, Conveniently—with equipment that provides both heating and ventilating facilities that can be installed quickly and requires no distribution ducts.

The Denver-Rio-Grande Railroad

found itself confronted with the problem of providing efficient and flexible heating and ventilating facilities for its various repair and maintenance shops and solved that problem, after extensive investigations by purchasing and installing

43 Bayley

B. T. U. HEATERS

The B.T.U. is a complete self-contained heating and ventilating unit that draws the cold air from the flooring through a series of steam coils and distributes the heated air evenly through the entire room. It is made of steel and iron throughout and requires no distribution duct system. Simply set on floor, connect supply and return piping and wiring to motor and it is ready to operate. Made with a variety of distribution hoods that make it especially suitable for heating industrial and railway shops and for temporary installations where properly distributed heat and flexible ventilating facilities are essential.

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Bayley Mfg. Co.

Dept. P. Milwaukee, Wis.

(Continued from page 42)

with two or three years' experience, and another with eight or ten years' experience, and the man with the shorter service, not being immune to the contagion, is head and ears better than the good old experienced war horse. Such a fact needs no psychological analysis.

The feature of experience which develops men, capable of development, is not the daily grind of running a job, but of the emergencies or casualties which are encountered.

Why has it been the custom to place so much stress on previous experience for promotion, or even induction into an organization. The reason may well be because after some considerable practical experience, a man's mind has been acted upon to the extent that it has been stimulated and even though receiving no parallel academic training, as such, his intelligence has been quickened, and has learned the fundamentals which are the foundation on which to build. He, therefore, should be the better man by virtue of this something called experience. But sad to relate, many have been exposed to this peculiar something, and have come out unscathed; they were initially immune, and equally sad such men are made bosses, because they have had the experience. There are men in supervisory jobs, and this includes some college men as well, who are hardly one degree better off today through their years of experience than the day they first started to work. They can dress well, appear cultured, and affect an intelligent air, but they would faint at the least intimation of an intelligence test, were such a test really reliable.

Years are spent getting experience, and strange to say, no one has ever pointed out just where or when it is to be used. It little matters in particular the detail nature of this something called experience. The main issue is that it be gotten, and through getting it, it be made to develop the intellect as well as the hands, while, if the development of one or the other must be sacrificed, let it be the hands. The ratio of manual workers to thinkers is always greater than unity.

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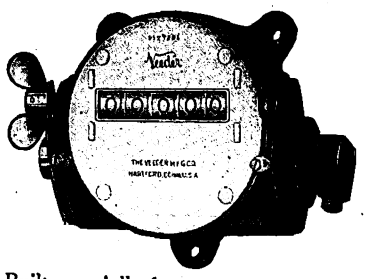
Are you getting larger production with each change in mechanical adjustments, speeds and feeds?

Is the operator of the machine getting *his* methods down fine?

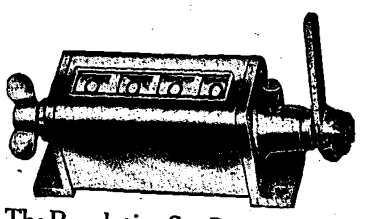
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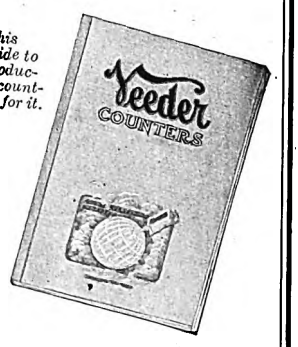


Built especially for recording the product of punch presses, metal stamping machines and other heavy-duty machinery. Strong stops limit the movement of the lever to 45 degrees or ⅛ turn, which registers one on the dial. The large, legible figures are easily read ten feet away. Counter is regularly furnished with five figure-wheels, and may be *set back to zero* by one turn of knob. Requires no special fixtures for attaching. Price $18.00.



The Revolution Set-Back Counter above records the output of any machine where a shaft-revolution indicates an operation. Sets back to zero from any figure by turning knob once round. Supplied with from fo ur to ten figure wheels, as required. Price with four figure-wheels, as illustrated, $10.00—subject to discount. *Cut less than one-half size.* Set-Back Rotary Ratchet Counter, to record reciprocating movements as on punch presses, $11.50 (list).

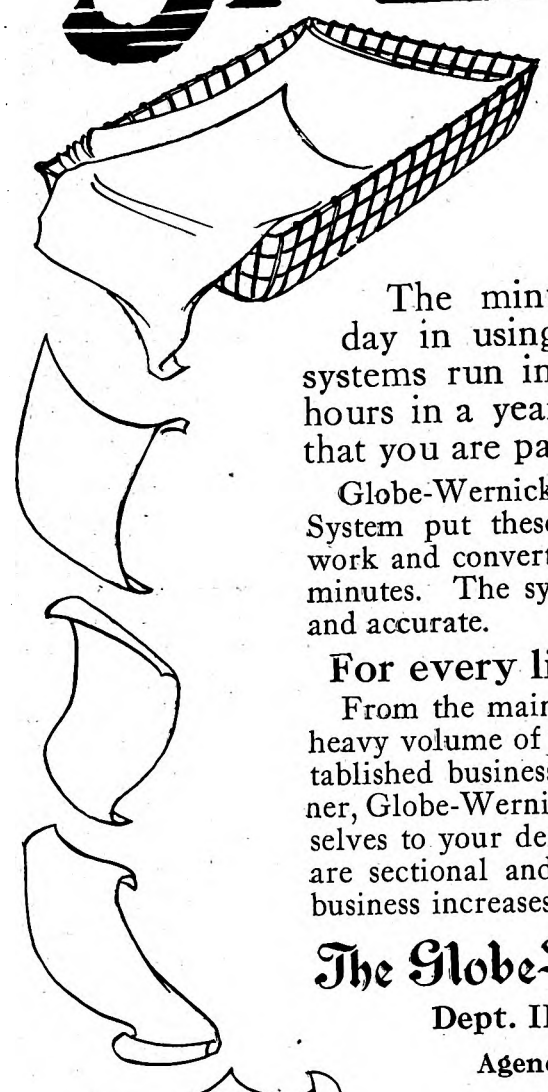
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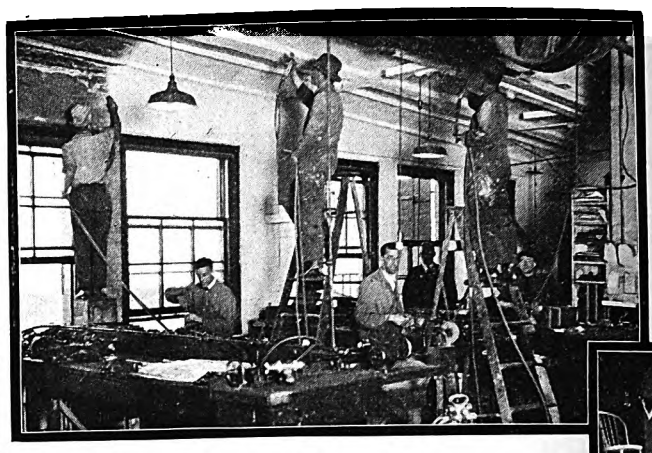
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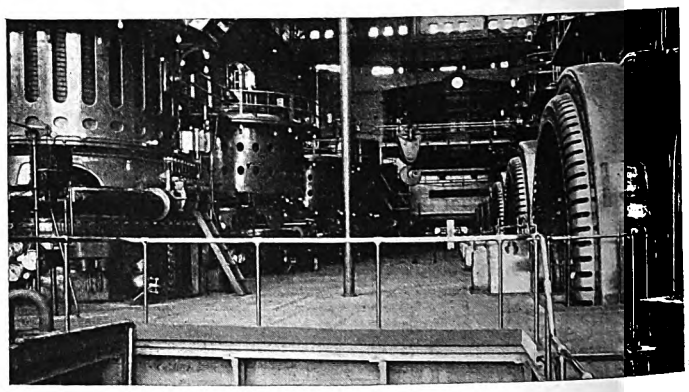
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Making the Factory Ceiling Pay Dividends

(*Continued from page 26*)

hoist, figures 23, 27, 28, 29, etc. The operator rides with these machines and controls all the functions from the cab. Cab-operated telphers are employed where the equipment is called upon to do considerable travelling and where the capacity is large, necessitating a high travelling speed or where the distance per trip is sufficient to permit high speed.

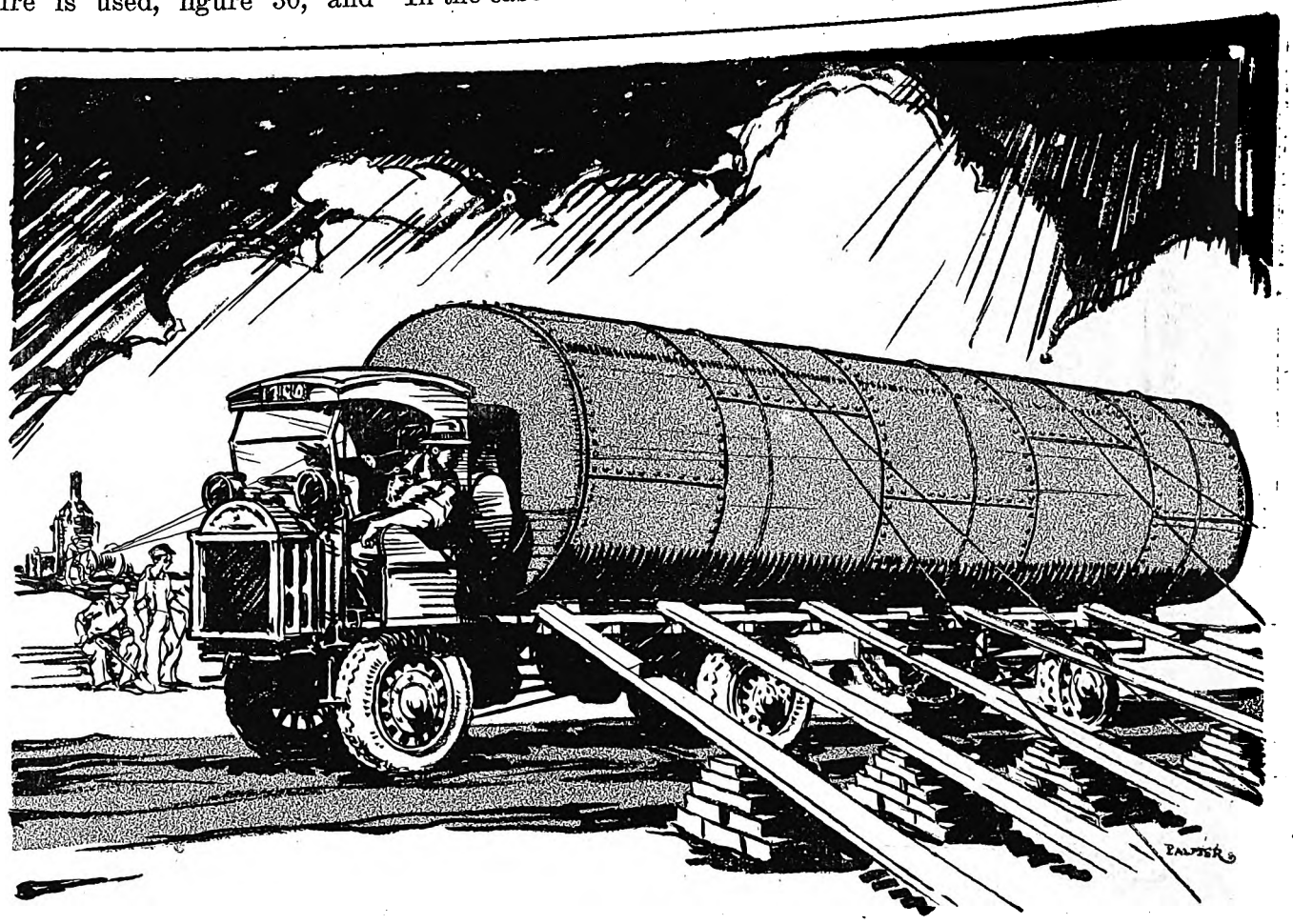
There are many different types of tracks or monorail construction from I-beam to special section. In most cases, however, the point is to have the load riding on two wheels or flanges. Some of the telphers and trolleys ride directly on the I-beam flange, but then considerable wear is incurred and frequently these I-beams have to be renewed. Some manufacturers, therefore, fasten T-rails to the bottom flanges of the I-beams, especially where heavy loads are carried and telphers are used. In the case of simple trolley-monorails, a special built-up section is the rule.

Switches and curves are the most difficult points in this system of transportation. The switches are generally hand-operated, and it is necessary to bring the telpher or trolley to a stop before passing through the switch. Switches are generally of the stub type, in which the whole switch is thrown from the main line to the branch track. These switches are made in either two or three directions from the main line. This gives excellent flexibility to the system. In the case of telpher-monorails, some switches have been designed so that the switching can be done by the operator in his cab, and it is not necessary for him to bring the monorail to a halt in order to throw the switch. The method of operation in this case is not intricate and has been developed to a point where it is quite positive, and because of the many safety features, there are now many of these automatic switches in operation. The main point to consider in switches, is perfect alignment.

When using electric power for propelling the trolley or telpher, it is necessary to provide conductors along the line of monorail travel. These are usually held in position by special equipment, and contact is made by means of a sliding show in very much the same way as the subway third-rail system is operated, figure 29. Sometimes ordinary trolley wire is used, figure 30, and there are various other types of conductors on the market.

Monorail systems are most efficient when travelling in straight lines and on the level, although if necessary, they can be made to operate on a 5% grade without much difficulty. In the case of some of the hand trolleys, a retarder is installed so as to permit transportation by gravity, but in this case it is usually necessary to install a power conveyor to engage the trolley when running the load uphill.

Curves should be as large as possible, particularly where



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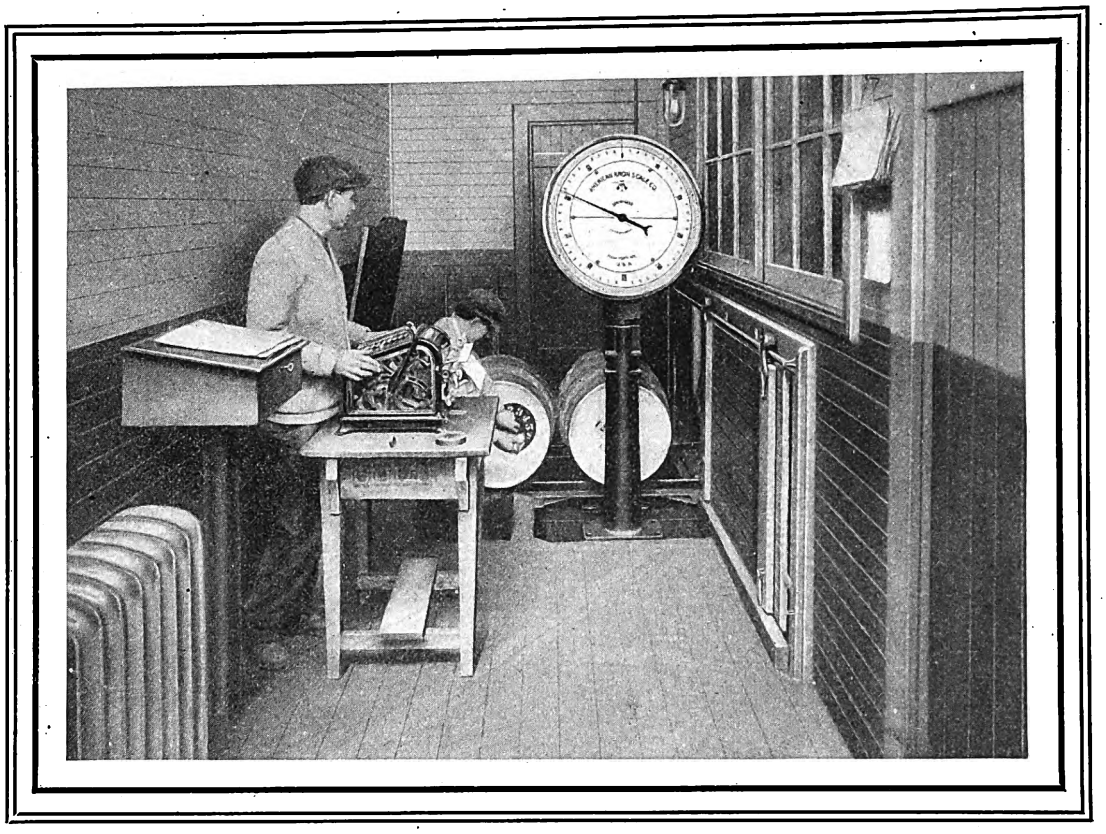
telphers are used. It might be said at this point that some of the first unsuccessful installations of monorail systems were due to curves and switches. There was a tendency on the part of some manufacturers to try and make a small radius curve in order to be able to perform certain operations and to get around obstructions. Short curves can be made on light equipment, as that shown in figures 1, 3, 5, and 15, or it might be said where only trolleys are used, but where monorail construction is heavy, and telphers carry the load, it is necessary to have large radius curves, in order to reduce friction and permit the equipment to take these curves at a fairly high rate of speed. The track supports, as shown in figures 21 and 29, should be widely spaced at the curves, so that the line of travel of the telpher can be free of obstructions. The reason for this is that if the load is travelling at an appreciable speed, there is a certain amount of centrifugal action on the load, which tends to swing it out, and for this reason ample clearance should be given.

The old type of switch was more or less of a makeshift, and seldom stood up after being in operation for a short length of time. The result was that trolleys jammed at switch points, and telphers travelling at high rates of speed frequently became wedged, causing serious delays, and as some of the first installations were not provided with safety devices, the result was that accidents occurred by telphers running off open ends of tracks and through open switches, where the switch had been thrown after the operator had passed.

Today, however, switches have been perfected for both the trolley and telpher, and have been provided with all the necessary safety devices to eliminate accidents at these points.

To show what can be done by trucking on the ceiling, with this equipment, we will look at figure 1. This view is taken in the foundry of the Redington Standard Fittings Co., of Redington, Pa. Those who are familiar with foundry operation realize the necessity of using every foot of floor space, and at the same time of being able to get the metal to the moulds with the least amount of man effort. The overhead monorail is of the light construction type, and the tracks are so placed that every foot of floor space can be served. The handles for throwing the various switches can be seen to the right, and to the left of the main line from the cupola. There was no record kept of the savings made by installing this equipment, but production was speeded up considerably, and better working conditions were some of the direct benefits.

As pointed out in previous articles, it is not always the money saving that should govern the installation of materials handling equipment, but working conditions should be given every consideration, and the dependability of the equipment over manual labor is a deciding factor. Time is saved and production is appreciably increased if operators at machines are provided with dependable hoisting facilities. All the necessary lifting can



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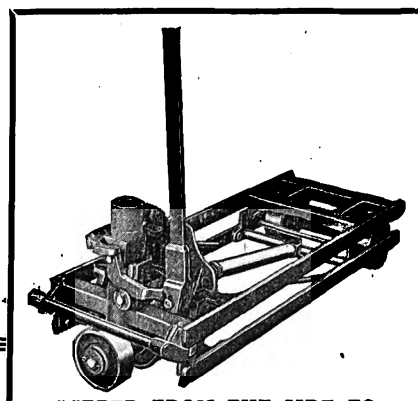
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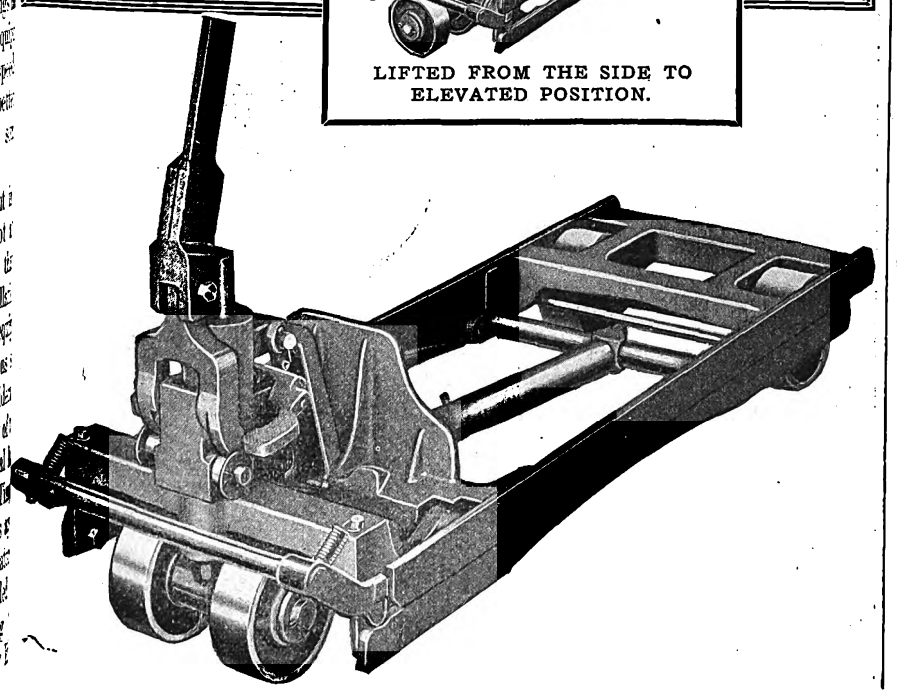
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then be done by one man, without his calling other operators from their work.

The policy of the Manhattan Rubber Company is to give each man all the mechanical help possible, to secure the highest efficiency in the performance of his particular job, and the hoist shown in figure 6 is a mechanical helper equal to the task of lifting 1,000 to 1,800 pound rolls of rubber, into 24″ to 66″ calenders. The service is severe, being constant for 24-hour duty, with approximately 180 lifts a day. They are not costly to operate, and they stand up under severe service.

Plant executives are now beginning to grasp the advantages of providing mechanical help wherever possible. Even the small shops are following this same procedure, and garages are using electric hoists and trolley monorails as shown in figure 7. There is no need of lying down under the car and working in cramped quarters, when the work can be elevated as shown. Note the adjustable stands and removable bench for tools to work with while under the car. Practically half the time on repair jobs was saved by installing this equipment, because of the greater amount of light and the convenience of getting at the various nuts and bolts.

It is of course always desirable to show something more than better operating conditions, and the steel warehouse of the Edgar T. Ward Sons' Company, of Brooklyn, have found that four monorails equipped with trolleys and chain hoists produced a savings of two men's wages, and increased the storage space 50%, as by lifting the load by chain hoists, they could pile the material higher. The total amount of material conveyed each day of nine hours in this warehouse was from 45 to 50 tons, only four men being required. Thus labor costs were cut in half and time reduced by 50%, (figure 8).

Materials handling equipment, whether it be trolley and telpher monorails, elevators or conveyors, is not limited in its adaptation to any one industry. The illustrations accompanying this article show this equipment operating in foundries, car shops, rubber plants, automobile re-

Rapid Action Valve

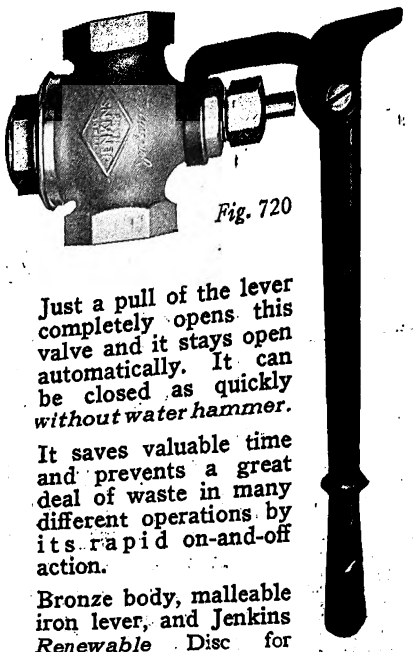
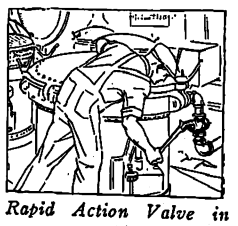


Fig. 720

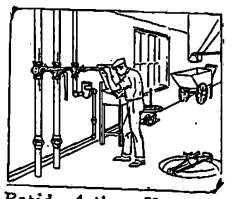
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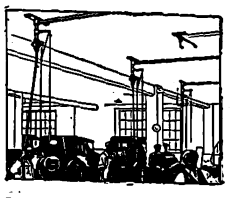
Rapid Action Valve in use on cooking vats in canning factory.



Rapid Action Valve in oil, air, and steam lines to generating set in gas plant.



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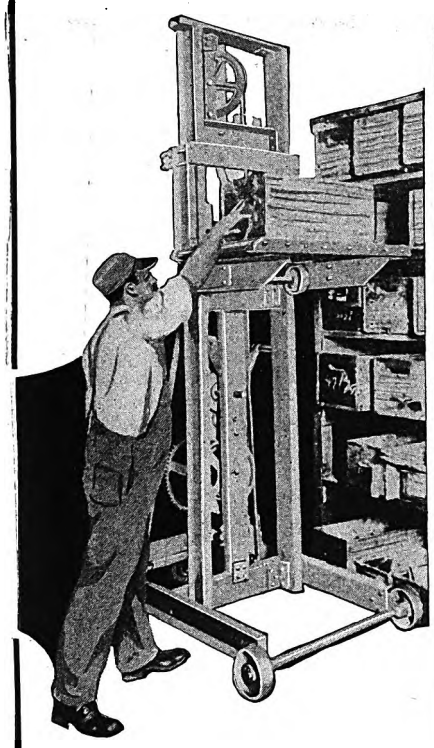
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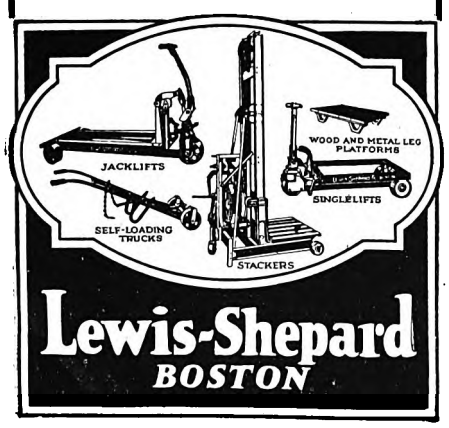
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Consider how difficult it would be to handle the pianos shown in figure 9, by any form of truck, and the amount of space it would require if they were left on the painting benches to dry. It is a saving of valuable floor space that often brings about the installation of materials handling equipment, but in the case of figure 10, in the Fox Film Corporation, it was a case of ease of handling and quick shifting of sets which caused the installation of the trolley-monorail.

Plant executives who have a knowledge of materials handling equipment, or who will investigate the various types of equipment on the market, do not only save money by cheaper operation, but frequently save money on the initial installation. The Sopar Company, at Philadelphia, used to receive the raw paper, from which they manufactured tickets and tags, in 500-lb. boxes. These were formerly raised to the second floor on a hand operated elevator, and it took two men 15 minutes to unload a box, load it on the elevator, raise it to the second floor, and unload it. As these boxes often came 25 at a time by truck, the unloading of them held up production, because the same elevator was used for other purposes. The installation of an electric hoist attached to a trolley-monorail, extending outside of the building, as shown in figure 11, has saved considerable time and money. It now takes only three minutes for one man to unload and hoist a box of paper, which saved $108 a year on labor alone; but the biggest advantage is more even production, and freeing the elevator for other purposes for which it is more adapted. Before installing the electric hoist, they had considered the installation

(*Continued on page* 54)

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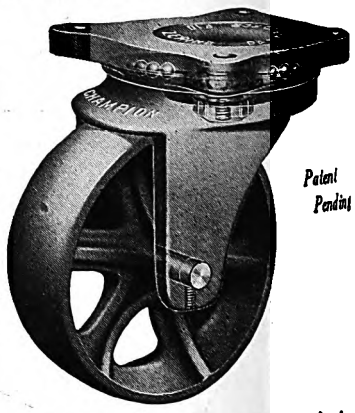
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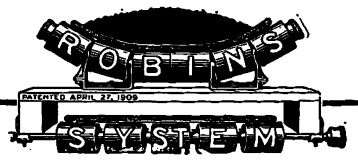
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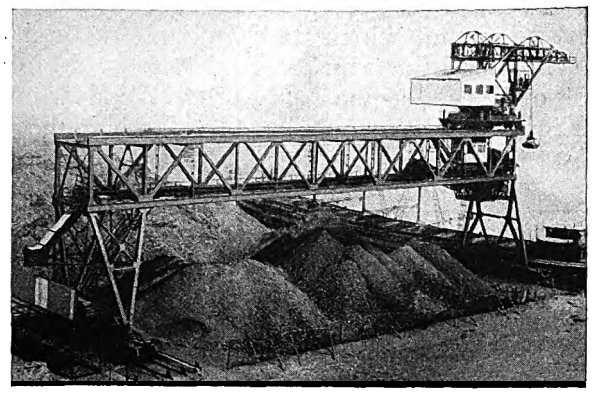
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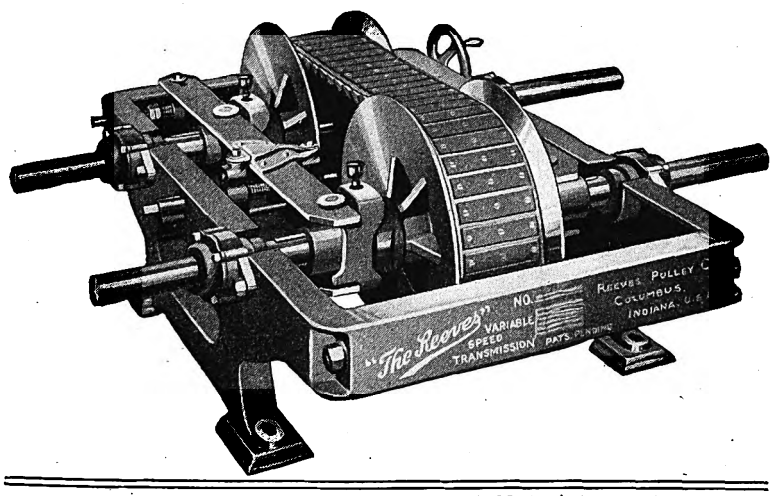
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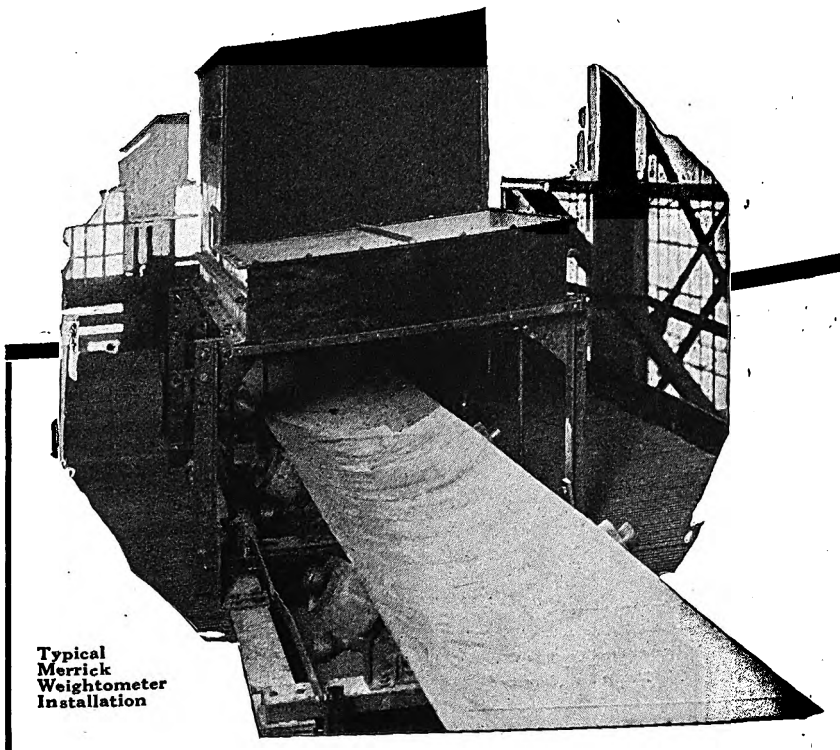
It will enable the operator of the machine to secure the correct speed for the material in operation. Any one speed may be maintained indefinitely or the speeds may be changed as often as necessary.

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Over 25,000 in operation. Sizes 1 to 150 HP.
Speed Variations, 2 to 1 up to 16 to 1.

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WEIGHS WHILE IT TRAVELS

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(*Continued from page* 52)

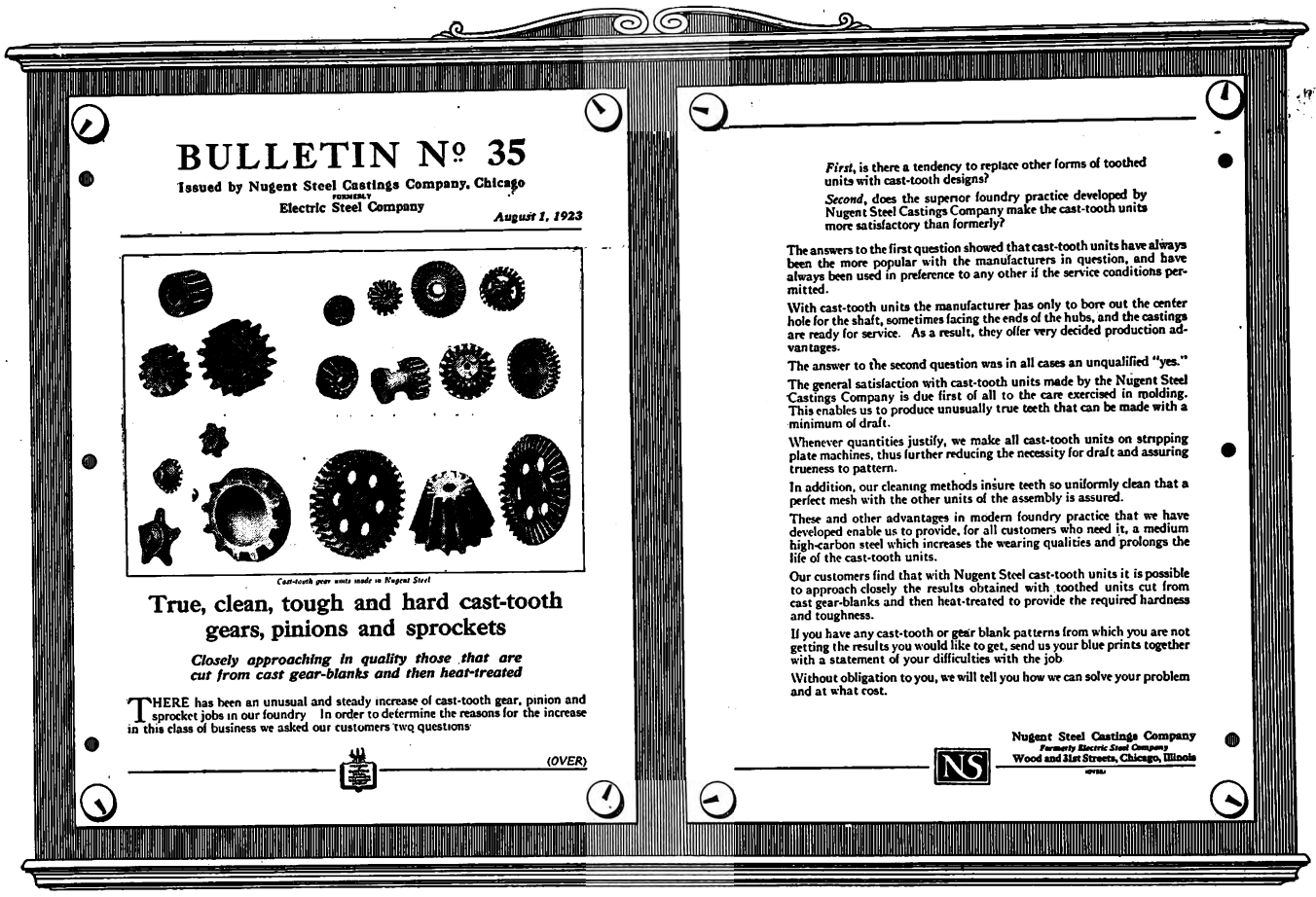
of a power elevator, which would have cost in the neighborhood of $2,500, but by installing the equipment as shown they saved $2,200 in investment, and the operating cost of the hoist is also considerably lower than the operating cost of a platform elevator.

These are startling figures, but there are so many instances of this nature that there is a tendency to overlook them, thus thousands of dollars are wasted annually.

The readers can get an idea of the various types of hoists, monorails and telphers from the accompanying illustrations. Figure 1 shows a chain hoist attached to a simple trolley, operating on a special monorail section. Figure 2 shows a chain operated trolley, operating on an I-beam monorail, and equipped with a special hoist supporting beam, which permits the hoist to be run into and out of cars, locomotives, etc. Figure 14 shows an electric hoist fastened to a trolley, operating on an I-beam monorail, while figure 16 shows an electric telpher operating on an I-beam monorail with an additional monorail and trolley for supporting the control mechanism, instead of having the operator ride in a cab.

Figure 23 shows a cab-operated telpher-monorail, while figure 24 shows a cab-operated telpher-monorail acting as a locomotive, and pulling two trailers equipped with electric hoisting units. Figure 26 shows an electric telpher, to which a cab is attached, supported by a trolley. Figure 26 shows very clearly the use of a transfer crane in connection with the monorail system. It would be very difficult to equip this plant with the necessary curves and loops in order to serve each machine, but the use of a transfer crane running in a longitudinal direction is able to serve a number of tracks running transversely. These monorails can be seen to the left of the illustration, directly over the machines. Movement of the transfer crane is controlled entirely by the telpher operator without him leaving the cab. By automatic safety stops, perfect alignment is assured between the short transverse tracks and the transfer crane.

It will be noted that the telphers usually run on heavy I-beam sections, while the trolleys can operate on either I-beam sections or special built-up sections of rail. These illustrations show clearly that monorails and telphers can be used in many industrial operations where some method of quickly lifting and transporting the materials to various parts of the plant is essential. The character of the work required of these hoisting and transporting machines in many of the processes of manufacture, precludes the use of overhead travelling cranes, especially in cases where comparatively light objects must be moved from one department to another. In this instance, some form of hoist and travelling unit, or a monorail has been found best adapted to the work; the monorail, being supported from the ceiling or other overhead portion of the building, may be installed without interfering with operations in the area underneath, and is therefore particularly applic-



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erating in places as shown in while figures 1, 8, 18, 22, 23, 26, 32.

e telpher in the transporting of ma- ann rials between buildings, it is mon metimes impossible or too ppor pensive to provide the neces- , inst y concrete roadways for the or rie of industrial trucks. Be- 23 shows se the line of travel is not her- rect between points, it is im- hows ssible to install conveyors. nora is is another place where and application of a trolley or upp her monorail system will its fin found advantageous.

telpher Figure 15, shows the yard shel rage of concrete blocks in Figu E. Hamilton Sons plant of the troit, Mich. It shows how in o rolley-monorail is used and il sh w one carrier transports 45 fficult cks at a time. The struc- he re is erected of wood, and in o s not expensive, when com- e, ared with the cost of grading ane d putting in a concrete road- dire y for industrial trucks. It nu ould be noted how many ansv itches occur in the main line, an h as to allow free entry into lust manufacturing building.

Another application of norails and telphers is in tdoor yard storage, either k coal or lumber, where it uld be again impossible or expensive to put down the essary roadway for trucks. stallations of this character shown in figures 25, 27, 29, 31, and in the plant of the kering Lumber Company, Haslan, Texas, the use of rhead structures and tel- er monorails similar to se shown in figure 30, have de it possible to handle nber at a cost of approxi- tely 6 to 12¢ per thousand rd feet. The cost with nd labor and horse trans- rtation varied from 50¢ to 00 per thousand board feet. addition, there was a con- erable saving by installing overhead carrying struc- e instead of roadways.

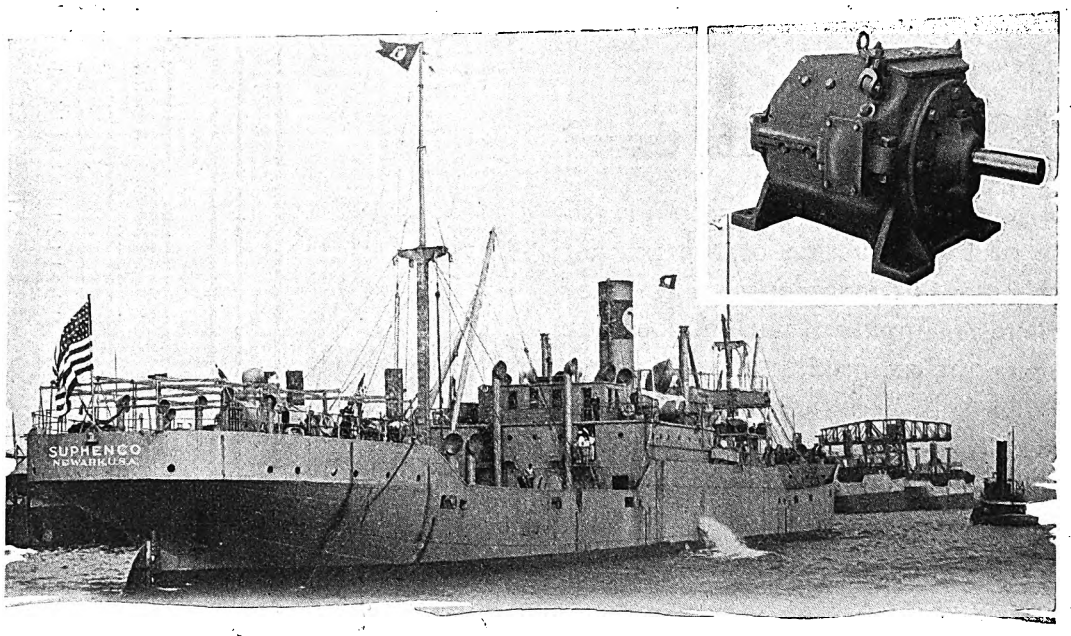
It is somewhat difficult at st to justify the use of trol- and telpher-monorail sys- ns, as the engineer and plant ecutive is always looking for possibility of using a con- or, in order to obtain the vantages of a continuous ca- city, instead of the intermit- t carrying which is neces- rily the case when this equip- nt is used. There are, how- r, cases where the monorail positively the most applic- le and most economical piece equipment to be installed.

There is a successful and strik- ing illustration of this equip- ment at the warehouse and pier of the Warner Sugar Refining Company, Shadyside, N. J., where a number of telpher- monorails are used for hand- ling the sugar in bags from shipside to warehouse and from warehouse to refinery conveying equipment, where the bags are opened and the raw sugar discharged. These monorails are not only used for transporting the load, but they are arranged in such a way that they elevate the load, and thus eliminate the extra handling on piling. It would be impossible to handle the sugar on this pier and ware- house with any other type of equipment as economically as it is being handled with a tel- pher-monorail system.

In pier work, telphers are frequently used as locomotives, and the train consists of a power driven telpher, and two or three trolleys, having a total capacity of about four tons when fully loaded; figure

(Continued on page 57)

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Need No Attention Prior to Unloading at Port

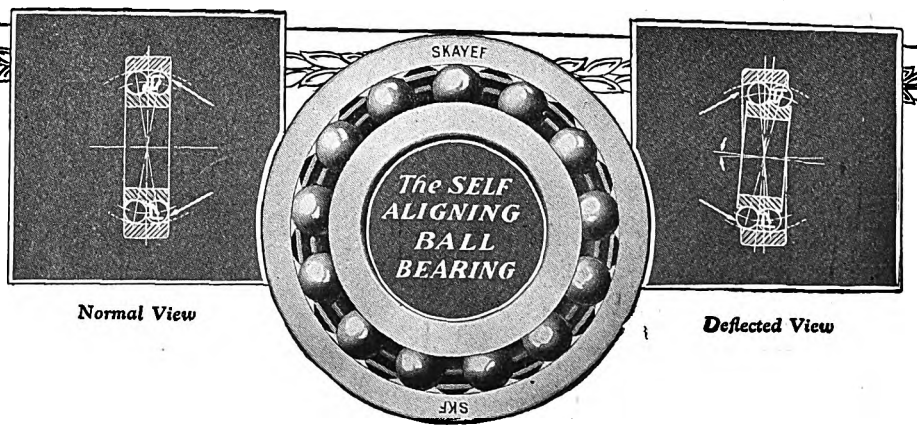
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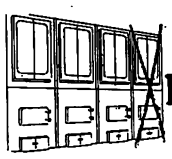
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Ten per cent of the total coal burned is a conservative estimate of the saving of automatic stoker installations. In addition to this economy is the saving effected by burning the cheapest coal in the local market—coal that is always available.



Five men or three?

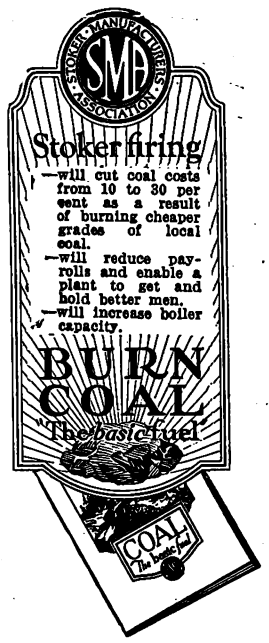
This is an equally conservative estimate of the reduction of the payroll in the stoker fired plant. The labor problem is simplified, not only because less men are required, but also because working conditions are so greatly improved that it is possible to employ a better class of men who become fully satisfied with their jobs.



Four boilers or three?

In many plants, particularly where wide fluctuations and sudden "peak" demands for steam are encountered, the ability of the stoker-fired battery of boilers to deliver a far greater amount of steam enables the load to be carried with fewer boilers than would be necessary with hand firing. Where plant expansion has made necessary a greater amount of steam for power or processes, it is well to determine whether the installation of stokers will enable the existing boiler equipment to carry the load as a result of increased capacity, thus allowing the stokers to pay for themselves through the elimination of capital investment in new boilers.

The exceptional advantages of stoker firing are told in a non-technical way in an interesting book, "Coal—The Basic Fuel." Have you read it?

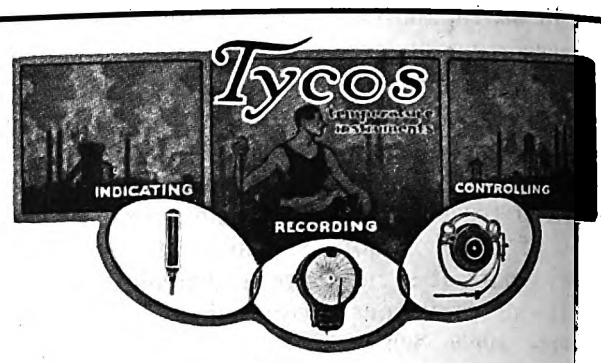


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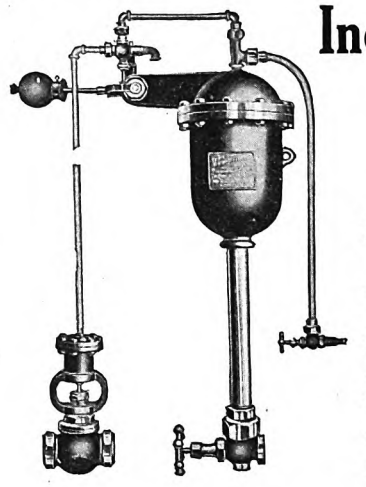
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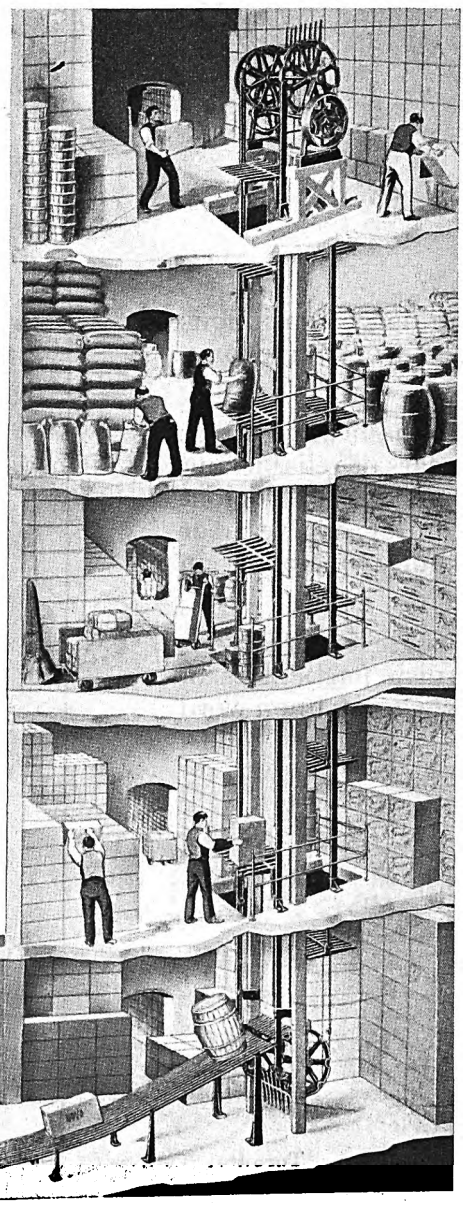
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(*Continued from page* 55)

24. In one of these installations, the complete train was only 30 feet in length and maintained an average speed of 700 feet per minute. This equipment, with one man, performed the work that formerly required several teams and men. The trolleys permit each sling load to be kept separate and in this way the telpher's pulling capacity is used to advantage and the volume handled per trip is materially increased.

Many adaptations of the telpher-monorail system have been made to handle loose materials with grab buckets, magnets, etc. Some installations of this character are shown in figures 21, 22, 23, 25, 26, 27, 28 and 33. The installation of an overhead monorail system may entirely supersede the use of manual labor or of trucking material by teams or by other forms of transportation. The ease with which it is possible to maintain overhead trackage in many otherwise inaccessible places such as over ravines, rivers and rough country where it would be impossible to establish any of the other means of transportation gives to the monorail system many advantages, and has led to their extensive use for outdoor work, and to transport materials for considerable distances.

The heavier types are now used chiefly on such outdoor work as lumber yards, coal piles, coal mines, etc., but have also been used successfully inside industrial plants such as power houses, warehouses and mills, and it can be said that they may be used wherever the need is great enough, and where the necessary trackage can be installed.

Because a hoisting unit is required in a monorail system, it is easy to equip the hoisting unit with either a plain hook for handling slings of materials, or they can be equipped with other hoisting accessories, such as a magnet for handling metals, automatic grab bucket to handle fuel in power plants, or for operations such as handling gravel, sand, etc., or they may be equipped with any of the various types of grab hooks, clamps, and grapples, etc., where odd shaped and assorted materials are to be handled. Almost any type of container can be used with

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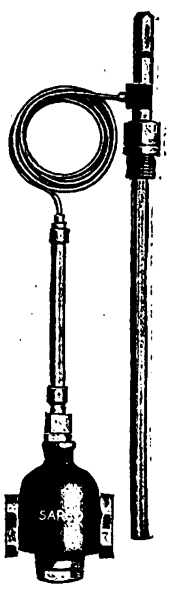
A special safety device prevents over-temperature from straining the instrument.

Only enough steam is supplied for the job, by its gentle throttling action—instead of supplying a large quantity and then shutting it off entirely. No other self-contained instrument has such a fine control as the

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this equipment for transporting materials about a shop or in a warehouse.

The monorail system has many advantages over any other form of conveying equipment, the principal ones, being:

(a) Considerable speed may be obtained with telphers, inasmuch as they travel on rails which are above the ordinary road or plant trucking. This speed may be as high as ten miles per hour. This is a distinct advantage when the distance between buildings is great. For example, in the Hood Rubber Company in Massachusetts, there is a set of monorail tracks which cross a part of the plant property, the railroad track of the Boston & Maine Railroad, and the property of another company, before it reaches its destination.

(b) The monorail system cannot be blocked by traffic in the roadway or by congestion in the aisles of the manufacturing building. It passes over all obstructions of this kind. The only way it can be obstructed is when another telpher or trolley is on the same line, and has to be stopped for some reason or other. In the case of the industrial truck which travels on the ground, if there should be a traffic congestion, or if the roadway should cross a railroad track, there would be times when the truck would be held up for a considerable length of time, due to congestion on the roadway or switching on the railroad. The monorail track in this case would be high above the railroad track and the telpher could cross independently of it.

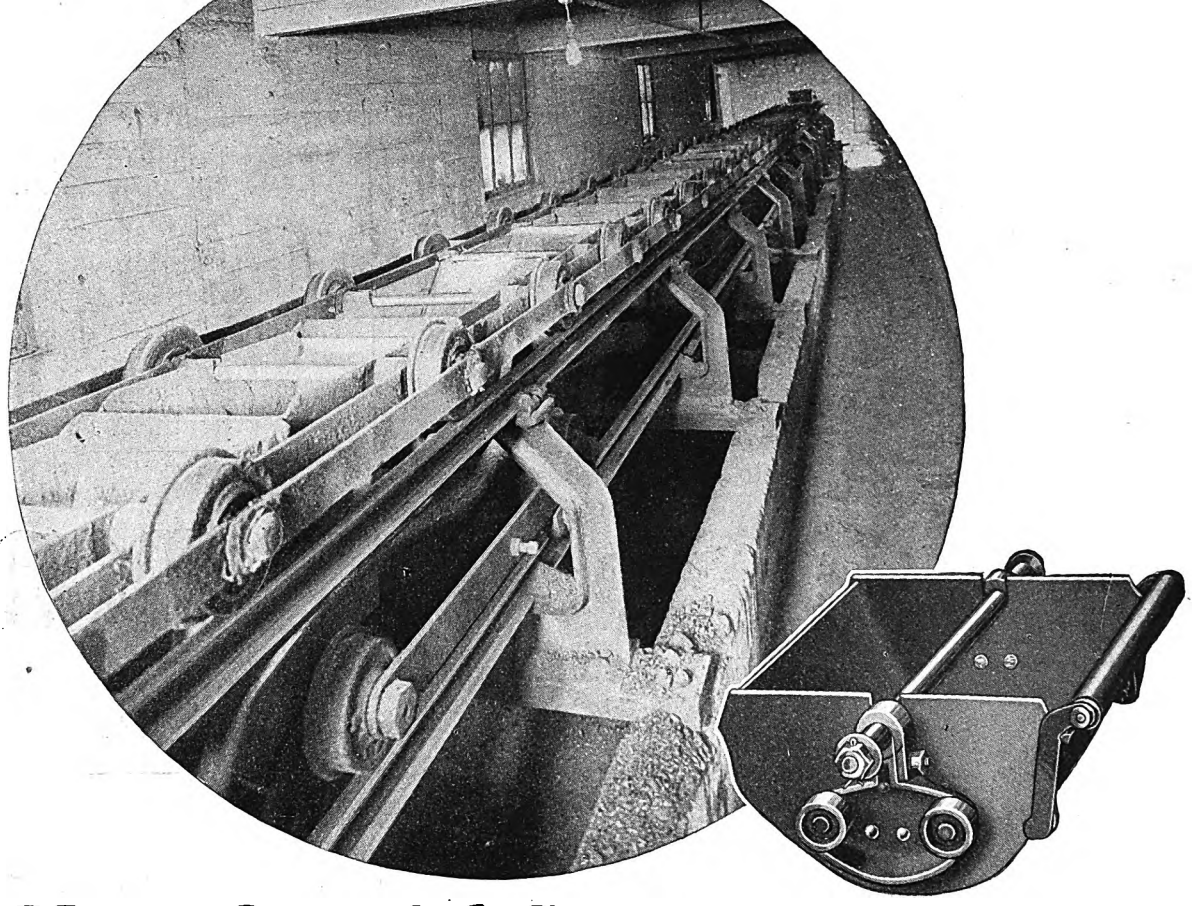
(c) With a monorail system of transportation, there is no loss of floor space for aisles. The aisles may be made only wide enough for walkways as the material is carried overhead. This enable machinery to be kept closer together, and a greater portion of the floor space made available. In the case of electric trucks or tractor trailers, the aisles have to be made wide enough so that the equipment may pass each other at any point.

(d) The monorail system of transportation can operate directly over in back of machinery.

All equipment that has advantages, generally has some disadvantages, and the monorail system of transportation is no exception to this rule.

(a) The rail and its supports are somewhat costly, particularly in the heavy duty installations, and the building has to be sufficiently strong to hold the loads which are imposed on it. This advantage will also occur to a certain extent where heavy trucking is done, inasmuch as it may be necessary to strengthen floors in order that the loaded truck may be safely carried.

(b) This system of conveying is not as flexible as industrial trucks and tractor trailers, due to the fact that it cannot leave its rail and travel into any part of the plant, but is con-



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fined to tracks. This disadvantage is not as serious as it may seem, and it is quite possible that in case the amount of traffic to be taken from any point is large enough, it would pay to build a monorail track to that point.

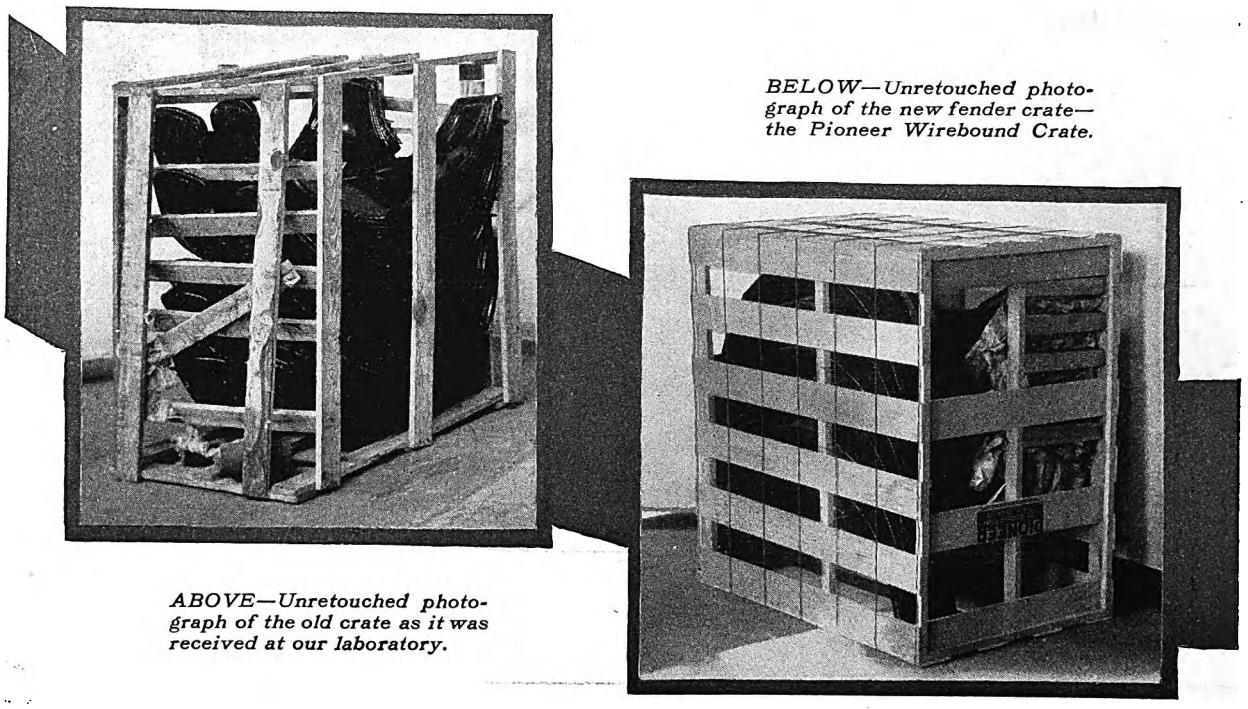
c) In order for the monorail system to leave the building, and cross open spaces, it is necessary for special overhead structure to be built. This is somewhat expensive, but it is not as expensive as a concrete or asphalt road which would be necessary for various trucking equipment. Also the monorail can follow an air line, and is not subject to conditions which would make the other equipment have to take a longer route.

In looking at any system of transportation, it has been previously mentioned that all elements should be taken into consideration. That is to say, combination of two systems is usually applied. It might be said without fear of contradiction, that no one form of conveying can solve economically all conditions of handling materials which may be met with in any particular manufacturing establishment. For this reason, it is best to consider the monorail or overhead tracking system and to be familiar with its application and operation. As previously pointed out, it would be impossible for any other equipment to perform some of the operations shown in the accompanying illustrations, and there is no doubt but that the installation of this equipment is saving money and operating efficiently in the installations mentioned.

Materials handling has now broadened its field to such an extent that executives should know of all the equipment that can be considered under this heading, and should not overlook the possible application of this equipment to many of his seemingly impossible materials handling problems.

Developments this month have reflected the irregularity of the general domestic business situation, divergences between the trends in different industries being especially marked. But, despite this condition as well as the fact that no great increase in the volume of production and trade is in immediate prospect, prevailing conditions justify a moderately optimistic outlook for domestic business as a whole. As was pointed out in a recent issue of this Survey, the present scale of business activity is high, as compared with any but peak standards. A resumption of the abnormal production and rapidly rising commodity prices which were the outstanding features of the spring boom is not a prerequisite of continued prosperity.

Financial conditions remain highly favorable. The banks have met the peak of seasonal credit demand with ease. Any rise in money rates of a magnitude sufficient to constitute a restraining influence is highly improbable. Failures have been surprisingly few. The number of insolvencies reported to Bradstreet's for September was the lowest monthly total in nearly three years.—*The Guaranty Survey.*



BELOW—Unretouched photograph of the new fender crate—the Pioneer Wirebound Crate.

ABOVE—Unretouched photograph of the old crate as it was received at our laboratory.

How an Automobile Manufacturer Reduced His Shipping Expense

HERE is a good illustration of what you may accomplish by analyzing more closely your packing and crating costs.

Note the difference in the two crates shown above.

The Pioneer Wirebound Crate gives ample protection to the fenders. The old crate weighed 62 pounds. The Pioneer weighs but 38 pounds—saving 24 pounds excess weight.

In addition, the Pioneer Crate can be assembled in a couple of minutes—saving a great deal of time and labor. The method of interior packing is different. The new method is quicker and easier—and the fenders carry better.

To uncrate, simply cut the wires at the top and the front of the Pioneer opens up. The fenders are easily and quickly lifted out. The crate can be re-used.

This is a typical example of what General Box Engineers are accomplishing for shippers every day. If you can use Pioneer Wirebound Boxes or Crates, it will pay you—and your customers. If you cannot, we will tell you so and may be able to help you with other suggestions. We make all types of wood boxes and crates.

It will not obligate you in any way to have a General Box Engineer call on you. This service is free. A booklet, "General Box Service", will be sent you promptly on your request.

GENERAL BOX COMPANY

508 N. Dearborn Street, Chicago, Illinois

SIXTEEN FACTORIES GIVE YOU CLOSE AT HAND SERVICE:

Bogalusa, La.	Detroit, Mich.	Illmo, Mo.	New Orleans, La.
Brewton, Ala.	East St. Louis, Ill.	Kansas City, Mo.	Pearl River, La.
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"The Straight Line"

BY L. B. GOUGH

Employment Manager, Magnolia Petroleum Co.

A STRAIGHT line is the shortest distance between two points; something we all know, but if more of us learned to *think* it we would save a great deal of lost motion. This axiom pre-supposes two essential points: the starting point and the objective you wish to reach; the desire to accomplish something, to become proficient at that task you are now engaged in.

No man is thrown out of permanent employment with a company for his over-production. Some other man's service might be discontinued because of the first man speeding up in production, which naturally raises the question, is the man that's going to be you, or the other fellow, and why! If we and our industries are to prosper, we must entirely eliminate the idea of getting something for nothing; we must produce something in return for which we are paid.

It is true that the greatness of any big organization, city or nation is not measured by the number of square miles it contains, but by the number of square people it contains. Honesty, efficiency, courtesy and service are four of the main-springs of a successful business, and with these attributes, no business is busted while there is a smile left in the bank. If you are not working along this plan, then speed up or make way for a good man.

Remember, however, that what one man would do to produce might not be production for another man, as there are different conditions surrounding each particular kind of work. This simply means to accomplish something on your own job before you begin looking over the fence at the other fellow's; then, when his or a similar job is open, you may be ready for it.

The four basic principles mentioned above—honesty, efficiency, courtesy and service—lead to accomplishment. Then, if accomplishment is the big thing, the question arises as to *how* to accomplish, *how* to get a definite result. We cannot all direct; and many would not be successful if given the opportunity. No conditions are ideal. We must adjust to them and improve them when we can. Face the facts, revive the old standard of sturdy, uncompromising American honesty. Be honest with yourself, your company and your fellow workmen.

(*Continued on page 62*)



Light haulage locomotive for quarry work. Equipped with cable-reel where not practical to erect trolley or third rail

G-E 50-ton third rail type for heavy yard service

For spotting cars this electric locomotive is equipped with side arms operated from the cab

Where Trolley Locomotives Serve

Long heavy hauls—continuous peak load traffic—shifting at terminals—incoming and outgoing freight—in these and many other phases of industrial haulage, G-E Trolley Type Locomotives are proving the better way.

Here are pictured representative types of G-E Locomotives for trolley and third rail service. Locomotives designed and built by the General Electric Company cover a range of sizes and forms wide enough to include any haulage requirement of this nature—and they incorporate principles of construction which are the result of many years of experience in this class of work.

When you buy haulage service, consider what our thirty years' experience in building complete electric locomotives can produce to exactly meet your requirements.

Interesting and valuable detail of the uses of electric locomotives for industrial haulage is contained in *Bulletin No. 44251* which will be mailed you free upon your request. Write for it today.

Special type G-E Locomotive for hauling and operating slag pots

Special type of third rail locomotive —showing G-E ability to fit particular service requirements

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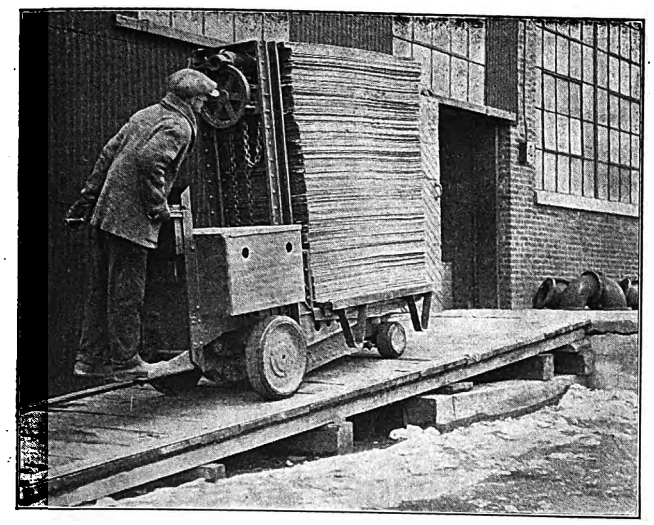
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ELEVEYOR—3 Trucks in 1—Performance
Lands Another Repeat Order



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The best proof of the money and labor saving features of ELEVEYOR Electric Trucks are the repeat orders after sufficient trial has been given them.

The above illustration shows the ELEVEYOR at the Continental Paper Company, Bogota, N. J. The fact that each ELEVEYOR does the duty of 3 trucks—a truck for conveying materials, a lift truck and a portable elevator for stacking—means thousands of dollars saved in the handling of materials.

And the savings effected has led to the purchase of additional ELEVEYOR Trucks just as they have done in other industrial plants.

Investigate the reasons for this.

ELEVEYOR INDUSTRIAL TRUCK CORP.
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NILES CRANES



Save time—Save labor—Save space with modern crane equipment

TONE QUARRIES with their necessarily large storage yards where very heavy weights must constantly be lifted and transported large users of Niles Cranes.

reful construction of details obviates any interference with perfect eration. Exposure to all sorts of severe weather conditions does not ect them.

ng life, security and low maintenance are the predominant characteris- s which make Niles Crane equipment a favorite in all fields of industry.

NILES CRANES
For the Steel Mill, Rolling Mill, Foundry, Shipyard, Quarry, Mine Yard, Locomotive Shop, Forge Shop, Central Station and wherever heavy material must be handled with speed, safety and economy.

Builders of cranes for every requirement

NILES-BEMENT-POND CO.
111 BROADWAY—NEW YORK CITY
CRANE WORKS— PHILADELPHIA, PA.

No. 7 *of a series illustrating the many industries served by Niles Cranes.*



Cuts the Cost of Reclaiming Coal

USED in conjunction with other equipment or used alone, the Scoop Conveyor is a mighty handy machine to have around for reclaiming or transferring coal from storage pile to boiler room.

It is ideal for loading small hand cars, electric dump trucks and similar equipment which in turn carry the coal into the boiler room. When the coal storage is not too far from the plant, two or more conveyors can be placed in tandem style, one feeding to another, and thus by feeding one machine the coal is delivered direct to the boiler room.

Well balanced construction permits extreme portability so that the machine can be easily moved about the yard.

Of course the same machine is used for unloading cars, storing coal and loading trucks or wagons. Any kind of coal, coke, ashes, sand, gravel, stone, etc., can be carried on the machine.

Thousands of users have found the Scoop Conveyor an extraordinary good investment.

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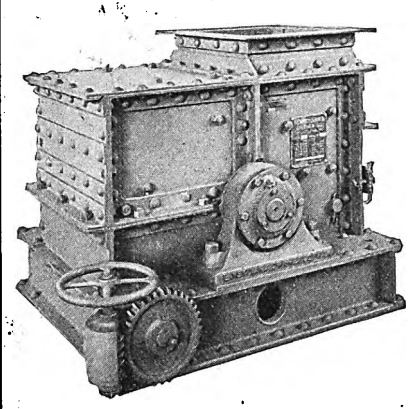
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ask any user

THE SCOOP CONVEYOR

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"PENNSYLVANIA" CRUSHERS

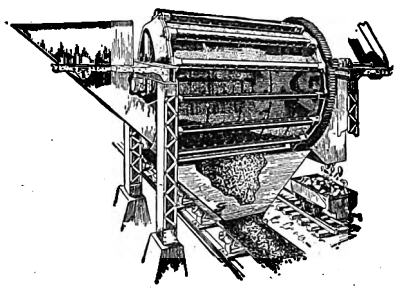


HAMMER CRUSHERS

39 Sizes

For Coal, Lime, Limestone, Shale, etc.

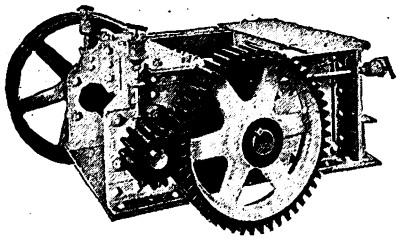
(a) Unbreakable Steel Frame
(b) Quick Adjusting Cage
(c) Oversize Bearings
(d) Patented Tramp Iron Separator
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BRADFORD BREAKERS

31 Sizes

Crushes and **automatically cleans** and prepares Stoker Coals, By-Product Coals, Gas House Coals and reclaims "Gob" coals. BREAKER UNDAMAGED BY TRAMP IRON.



SINGLE ROLL CRUSHERS

35 Sizes

For Coal, Lime, Limestone, Shale, etc. A remarkable Preliminary Crusher.

PENNSYLVANIA CRUSHER COMPANY

Stephen Girard Bldg., Philadelphia.
New York Pittsburgh Chicago

(*Continued from page 60*)

Efficiency has common sense as its basis. Without common sense there can be no efficiency. It is the basis that permits the executive to disregard fixed ideas and adopt methods without regard to prejudice or precedent. You cannot define it, but you must have it in you and about you if you are to accomplish.

If the man from the farm has come to the industrial plant and finds that he is unfitted and not adaptable to the conditions, then common sense should send him back to the farm; but if, with his energy and work, he crowds one of the "regulars" out of his job, then common sense should either speed the other fellow up or send *him* to the farm. Today is the day of the specialist. It matters not what branch of an industry you are in, there are some hundred different jobs to master which require application, study and work, so it is up to you to learn all there is to know about your particular job; then you will be in position to learn something about the other branches of the company for which you work.

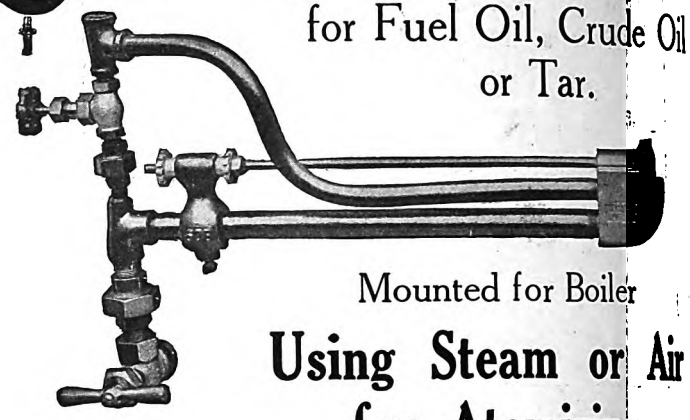
The next step to accomplishment is courtesy. It is that something that gives a man a new lease on life, something that cannot be bought and sold, but it is of great value. Be courteous to the new man, give him a chance to learn the things that you were taught. Give him counsel and advice, let him have the benefit of your knowledge and experience.

The fourth basic principle in accomplishment is *service*. It seems to be a law of human nature that we follow the line of least resistance. Without the will to do, there is no service. The success of a whole industry depends not alone upon its wealth, or its men, or its products, but upon the spirit of service, which is the energizing power in any organization. It represents the men who do things.

If you have builded on the theory of getting something for nothing, then your just reward would be nothing. Personality in a man is not what he *intends* or *pretends* to do, but what he *is*. It is the outward expression of the inward self. It is the man himself. On this basis is the reward for faithful services given.

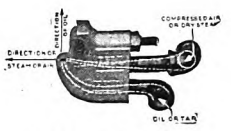
CALOREX Burners

for Fuel Oil, Crude Oil or Tar.



Mounted for Boiler

Using Steam or Air for Atomizing



CALOREX Unmounted

Note direction of arrows. The air or steam meets the oil at right angles, thus thoroughly atomizing the oil externally. This prevents *Clogging or Carbonizing* The burner is always clean.

WE HAVE been manufacturing liquid fuel burners for the past 33 years and we can safely say that the "CALOREX" is the most economical fuel burner to operate.

The "CALOREX" is simple in construction—no parts to wear out. It will last a lifetime.

It gives the most economical way to change boilers from coal to liquid fuel.

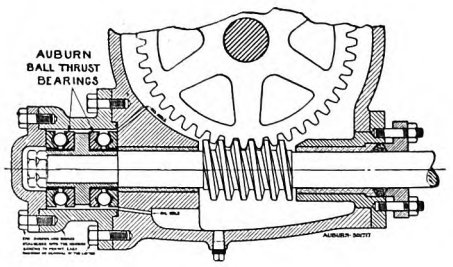
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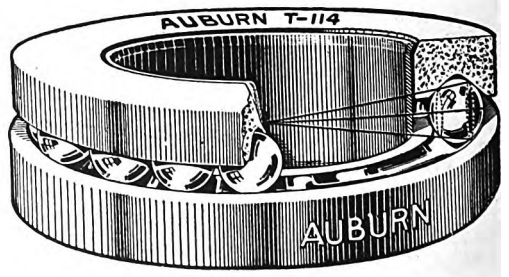
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WORM DRIVES operate more smoothly with AUBURN THRUSTS



The use of Auburn Ball Thrust Bearings with their minimum of wear and constant thickness insures the least amount of backlash, and avoids jerky starting and stopping of the worm drive. Auburn Thrusts thus tend to prolong the life of both worm and gear and make a smoother operating machine over a long period of time.



Send details of your problem and ask for data sheets.

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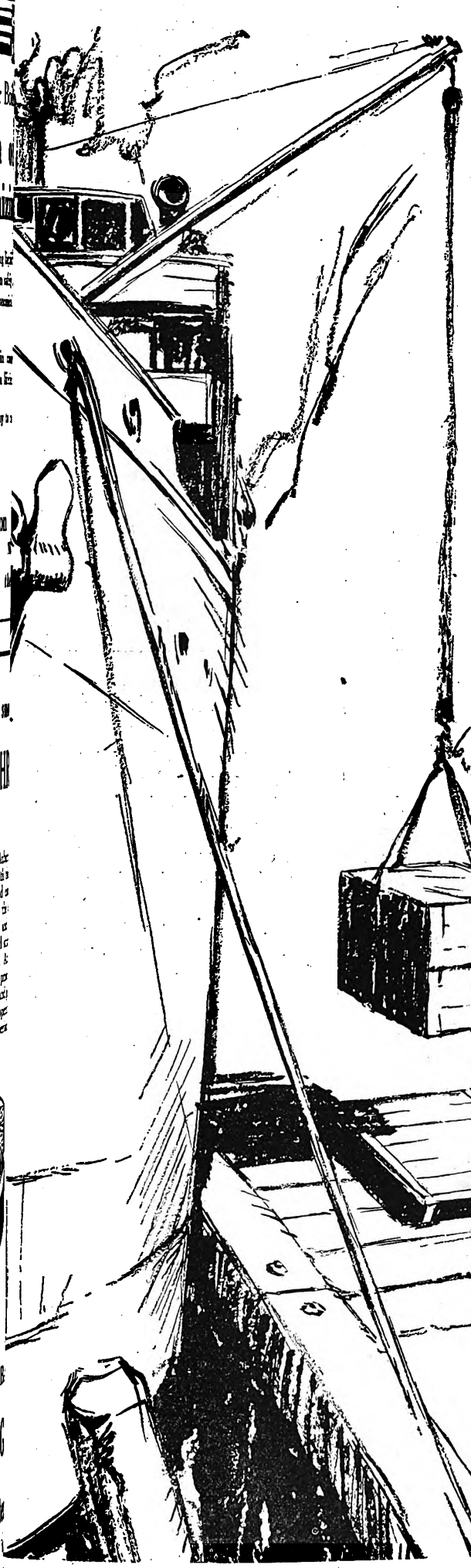
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Established 1893

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We find the Stuebing to be the cheapest and most efficient for our service"

President, Bush Terminal Co., New York City



Stuebings cannot hope to serve *all* Industry, much as Industry needs what Stuebings so adequately—yes, and so *exclusively*—provide.

There will always be those who underestimate their needs and content themselves with but a share of what could be their portion.

But wherever the need is fully realized—wherever the *full measure* of lift truck economy and efficiency is insisted upon—*there you will find Stuebings!*

For the directing heads of plants both large and small have discovered that lift truck savings are *real* only when upkeep costs are *low*.

And they have stopped the leak in their lift truck savings by standardizing on Stuebings—the only truck they could find built to meet their needs.

Take Bush Terminal in New York, for instance. For 2 years the repairs on 51 Stuebings in constant service amounted to only $65—*a trifle over 5c a month for upkeep!*

Try to duplicate that record with any truck other than a Stuebing and you'll realize that Stuebings *are* different from any other lift truck made.

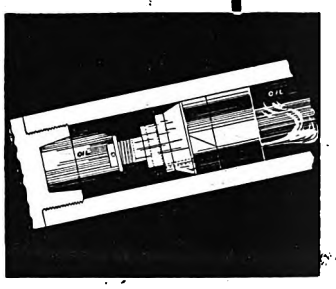
Because of the character of its design and the unapproached quality of its material and workmanship, the Stuebing is the *one* lift truck that is in a class with *fine machinery*.

And the fact that Stuebings serve in greatest number where costs are most closely scrutinized is a unique tribute to the foresight that anticipated Industry's *real* needs and provided a truck to meet them *fully*. Send for our new catalog.

StueBing

LIFT TRUCK SYSTEMS

NO OTHER LIFT TRUCK IS BUILT LIKE A STUEBING



The Stuebing hydraulic check is accurately machined from one-piece seamless steel tubing and fitted with oil-tight piston containing a split ring

The Stuebing Truck Company,
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The Industrial "Daily Dozen"

(*Continued from page* 13)

soon this feeling will disappear. If a concrete floor starts to dust or wear in spots, it can be treated with a hardener or paint. The best treatment differs for different conditions of service. A wood block floor which becomes badly worn can be torn up and patched fairly easily. When tongued and grooved hardwood floors become worn they are rather hard to patch if the boards are long and run under machines which are in use. It is, of course, possible to cut down with a chisel on a certain line and fit the new flooring into the old. If only the trucking aisle is worn it can be easily fixed by laying a new floor directly on top of the old one and beveling the edges where it meets the old floor. It is necessary to wedge shims on thin strips of wood at badly worn spots under the new floor as it is laid, so that it will be solid. When composition floors become worn they can usually be patched but if a waterproof job is required it usually will be found best to put on a new coating.

Walls and ceilings require brushing or wiping down occasionally to remove the dust. The length of time between cleanings naturally depends on the class of work being done in each particular room. Belts running at high speed throw dust onto ceilings and walls and this darkens the room. With a gloss paint the time between paintings can be increased but it should be borne in mind that white paint saves money in lighting bills. Where the walls are apt to be spotted by dirty hands it is well to paint them a dark green up to about five feet from the floor. This is called a "dado." Mostly all factories can use a white gloss paint and as this stays clean longer than flat paint, it should always be used unless the room in question is exceptionally bright. A medium gloss finish or eggshell finish is sometimes used as a compromise between gloss and flat. Concrete or brick walls at entrances to doorways and elevators should be protected by a steel angle iron corner to keep trucks from knocking off the corners of the wall.

It is a good policy to have a regular schedule of window cleaning and to live up to it. During cold weather it is usual to have cleanings much further apart but with the various cleaning compounds now available windows can be cleaned during cold weather. In order to clean the outside of windows where steel sash is used, a staging which can be hooked onto the sash is necessary. This can be about three feet wide and be light enough to be moved from one sash to the next. A wire or netting protection railing should be provided around the staging so the operator can't fall off backwards. Wooden sash which slide up and down are easily cleaned without equipment. Cracked or broken windows should be replaced at once as rain might damage work left near-by. If there are concrete buildings with plain glass it is



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a good idea to replace each broken pane with wire glass. Thus, in several years, there will be a large percentage of wire glass in place and an additional investment to complete the job will lower the insurance rates. With the prevailing high prices of coal, all swinging sash should be inspected to see that they are tight when they are shut. Ventilation is necessary but in zero weather tight sash are necessary if the building is to be kept comfortable. Long chains which will allow adjustment to a small opening are needed for cold weather. Sash should be gone over every Fall and reputtied so that storms during the winter will not damage work or goods left on benches along the wall. Continual slamming of lower steel sash will eventually loosen the frame from the concrete sill. It can be grouted in with a thin Portland cement or mortar patched with a plastic roofing cement. This grouting should be done in the Fall to keep out melting snow.

Janitors are necessary if proper care is to be given to toilet rooms, although one man frequently takes care of several. Toilets and washbowls should be thoroughly cleaned at least once a day and if possible, twice a day. If the janitor takes care of several rooms, a steel locker with a small stock of supplies should be located in or near each toilet room. Metal partitions with an open space of a foot or so from the floor are the most sanitary kind to have between toilets as no vermin can live in them. Concrete or other waterproof floors with a drain in them are ideal for toilet rooms as they can be washed down with a hose. With tile or other waterproof walls, the hose can be used on them also. Some kind of a disinfectant is absolutely necessary if a toilet room is to be kept sanitary. At frequent intervals all partitions, walls and equipment should be washed with a disinfectant solution to kill any vermin or bacteria. The management should let employees know that their health is being taken care of and their assistance in this great work should be cultivated. Soap is usually furnished in office toilet rooms only, because the men in the shop frequently need strong soap to get off the dirt. Cake soap is not as sanitary as liquid or powdered soap. There are many containers available for liquid and powdered soap. All toilet rooms should be well ventilated. If the natural ventilation is not enough, a small motor driven exhaust fan can be installed in a window. A good sized vent pipe leading to the roof will sometimes do the trick if there is a ventilater top on it so there cannot be any back draft.

Wooden partitions and stock racks require repairs when they become damaged by trucks or otherwise. Heavy loads of stock on racks will tend to make them lean to one end or the other and they should be well braced to prevent this, as they may collapse if they get too far out of plumb. Try a plumb bob on them occasionally. Steel stock racks should be kept plumb and have all bolts tightened from time to time.

If all power and light wiring is run in conduit it cannot be damaged but if old wiring is exposed it should be carefully



Here It Is!

THE most noteworthy improvement in design since the introduction of electric industrial tractors. Our new bulletin No. 106 explains in detail how this new Type-H tractor produces 25% greater work out-put efficiency.

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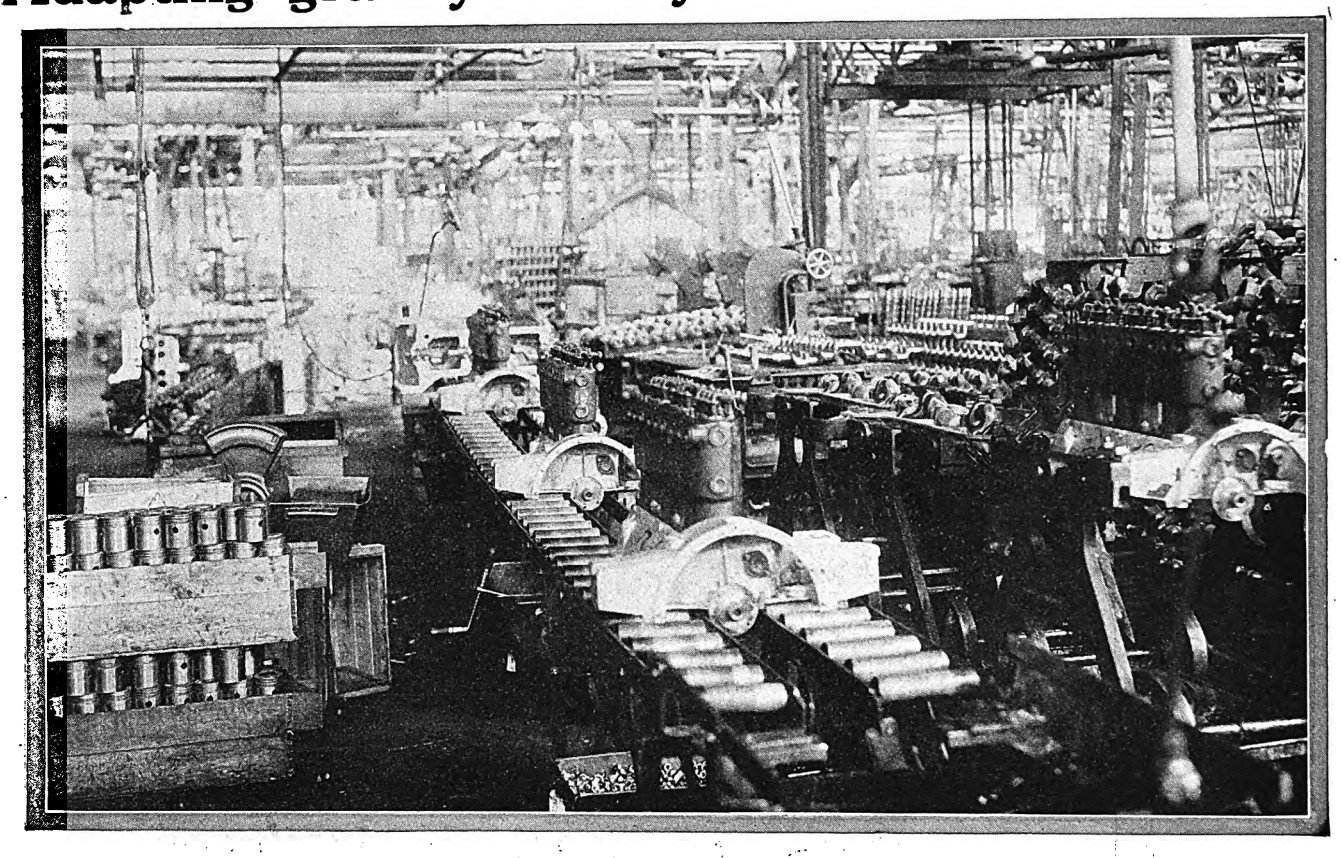
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watched to see that the covering is not rubbed off. General lighting units as well as individual lights should be cleaned at least every three months, and where they are exposed to excessive dust, every month. Shades should be washed at the same time. The small shades used on individual lights are not very expensive and a good way to do this work is to buy enough spare shades for one room and take off the dirty and paint chipped shades, replacing them with the new spare shades. Then the ones just taken off can be cleaned and painted and used in the next room. If your electric bulbs disappear, put on locked guards over the shades, or put on locked sockets. The cost will be repaid very soon. Fuses are an expensive item if they blow frequently. Where fuse bills are high have the electrician investigate and report on the advisability of using renewable fuses. Some circuits require circuit breakers but the head electrician should be convinced that they are necessary and advisable.

Valves on steam and hot water heating systems should be packed in the Fall as the old packing will be dried out and may cause a leak. Sagging steam pipes should be lined up so condensation won't pocket in them and cause water hammer. The valves at the return end of a two-pipe steam heating system should be in good working order. Dust on heating pipes smells bad when the heat is turned on, and it acts as an insulator too. Two good reasons why it should be brushed or wiped off. As steam mains expand when heated, expansion joints or large wide sweep bends are necessary to keep them tight. Long horizontal mains should be hung in roller hangers. The insulating covering on steam and hot water mains is very important and if it becomes loosened or broken off it should be repaired at once. The practice of painting each kind of pipe with its distinctive color is fast becoming popular as it enables the repair men to follow a pipe easily and quickly.

The importance of proper care and maintenance of sprinkler systems cannot be stressed too much. Valves which control large areas should be sealed open or shut as the case may be. The insurance companies' inspectors will watch for violations of this rule when they come around, but the safest way is to have the watchmen responsible for the way valves are set and sealed. In some locations the sprinkler heads corrode, and new ones should be put in at least every year. Sprinkler pipes should be painted at the same time as the ceilings. If the conventional color for pipes is carried out they will be painted red, although some prefer to have them white like the ceiling. Hose will rot quickly if not given care. Be sure it is dried after using it. It should be hung up in the stair tower for a day or two at least. Fire extinguishers should be refilled in accordance with insurance requirements and it should be the sweeper's or porter's job to see to it that water buckets are kept full at all times. Where oil is heated it is well to have a few buckets of sand instead of water and a soft asbestos sheet to smother

Adapting gravity conveyers to machine shops



Simpler handling increased production here—and costs nothing

THIS Mathews conveyer has proved an easier and quicker way to assemble the parts used in the construction of automobile engines, crank cases, etc. Motors-in-process ride conveniently from start to finish on smooth rollers and gravity carries them free—no cost for power and no cumbersome or slow handling.

This is just one of many industrials in which Mathews conveyers have sped up material handling by solving a special problem. And each of these industrials has realized a 50 to 75% saving in handling costs.

Further economy lies in the fact that Mathews equipment is built to last. Many conveyers have been saving for their users over a period of from ten to sixteen years *without a cent for repairs.*

Mathews Conveyers Applied to Your Industry

Our engineers will gladly consult you on your handling problems. There may be one or many places in your plant or shop where Mathews conveying equipment can reclaim many hours of labor and speed up production for a fraction of the present cost. Our entire experience is yours for the asking, or, a catalog of facts will be sent upon request. Write us today.

Mathews Gravity Carrier Co.
157 Tenth St.
Ellwood City **Pennsylvania**

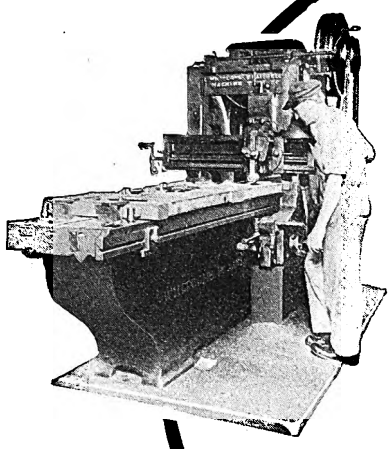
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When they want the highest class planing—

Hardinge Bros.—manufacturers of Printing Presses—perform their work on Whitcomb Second Belt Drive Planers.

Everyone knows the extreme accuracy and fine finish required on Printing Press parts—that is recommendation enough for Whitcomb planers.

For eight years this company has used Whitcomb planers on all kinds of regular production and also special work—always with the same exceptionally fine results.

You Can Get

the same results on most any class of work within the range of Whitcomb Planers.

What size planer are you considering?

Write for complete details.

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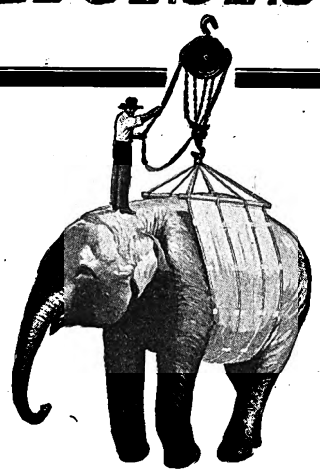
RAPID PRODUCTION LATHES
WHITCOMB PLANERS
SPECIAL MACHINERY

WORCESTER, MASS.
677 CAMBRIDGE ST.
Branch Offices and Agents Throughout the World

CYCLONE HOISTS

HIGH SPEED

—make elephantine lifts easy!



An elephant weighs about 5 tons. A pull of 109 pounds on the hand chain of a Cyclone Hoist will lift ***6 tons.***

This unique illustration of the easy lifting power of a Cyclone Hoist is presented to graphically drive home the unlimited possibilities of the hand chain hoist. While it is improbable that you have ever thought of lifting an elephant it *is* quite possible that you have many "white elephant lifts" on your hands about your plant,—places where a simple-operating, quick-acting Cyclone can replace time-taking hand labor, or cut delays caused by waiting for traveling crane service.

Distributors Everywhere

Send for catalog covering 1 to 40 Ton Hoists, Cranes, Trolleys, and Overhead Track Systems.

The Chisholm-Moore Mfg. Co.
Cleveland, O.

Hoists Cranes Trolleys
Overhead Track Systems

Branches: **New York, Chicago, Pittsburgh**

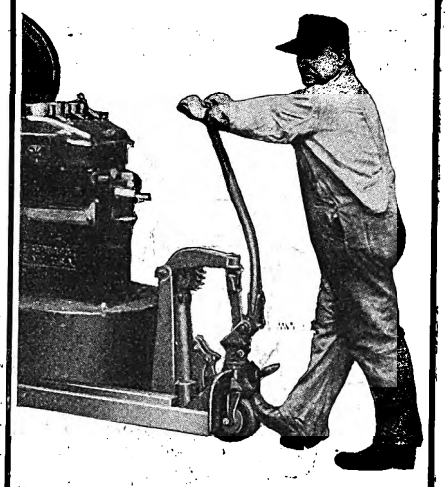
any flame. Each winter a great deal of water damage is done by sprinkler pipes freezing and bursting. Watchmen should close any windows left open by the workmen as the watchmen make their first round. Watchmen should watch the thermometers located in various place throughout the plant and report immediately to their chief if a room gets below 40 deg. F. That is a good margin of safety above freezing. When sprinklers are located in open sheds or in monitors of buildings where the monitor windows are constantly open, they should be shut off and drained in the winter unless they are on a dry pipe system which is especially designed for places without heat. Underground pipes are hard to get at quickly, so if important pipes are carried underground from one building to another, a pipe tunnel or at least a hardwood box culvert a few feet underground should be used.

Motors and fans on ventilating equipment need oiling and cleaning to keep them running. The piping or air ducts themselves should be painted to prevent rusting. A polishing room exhaust system is the hardest kind to keep in good condition by the very nature of the work itself. Lint from the buffing wheels will catch on the slightest rough spot and soon a large part of the area of the duct is filled up. Most good systems have cleanout holes along the duct. State laws require a certain minimum suction at the hoods and as soon as this minimum is reached the system must be cleaned. It is much better, however, to clean it out on a regular schedule and have a good suction at all times. The dust can at the bottom of the dust collector should be emptied every day to insure efficient operation of the system. When paint or japan are sprayed onto the product this work is usually done in a separate room or in a specially constructed hood as this vapor is highly inflammable. When the blades of the fan get clogged with the paint or japan it is necessary to scrape off or dissolve the deposit. If a motor is directly in the path of the paint laden vapor it is usually a totally enclosed one.

Roofs should be kept clear

The 4 Big "JACKLIFT" Points of Superiority

backed to the limit. Read How-*now*-to your profit



(1) Lifts in less space
(2) Lifts higher
(3) Lifts with less effort
(4) Lowest upkeep

To demonstrate these all-important advantages of the Jacklift—*PLUS* the tremendous profit to you in savings—we make you this

10-Day FREE Trial Offer

Let us put a Jacklift at work in your plant. We guarantee results — tangible, cost-saving, man-saving, profit-bearing results —*before you pay*

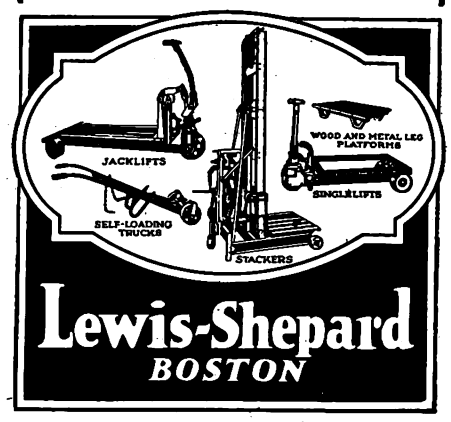
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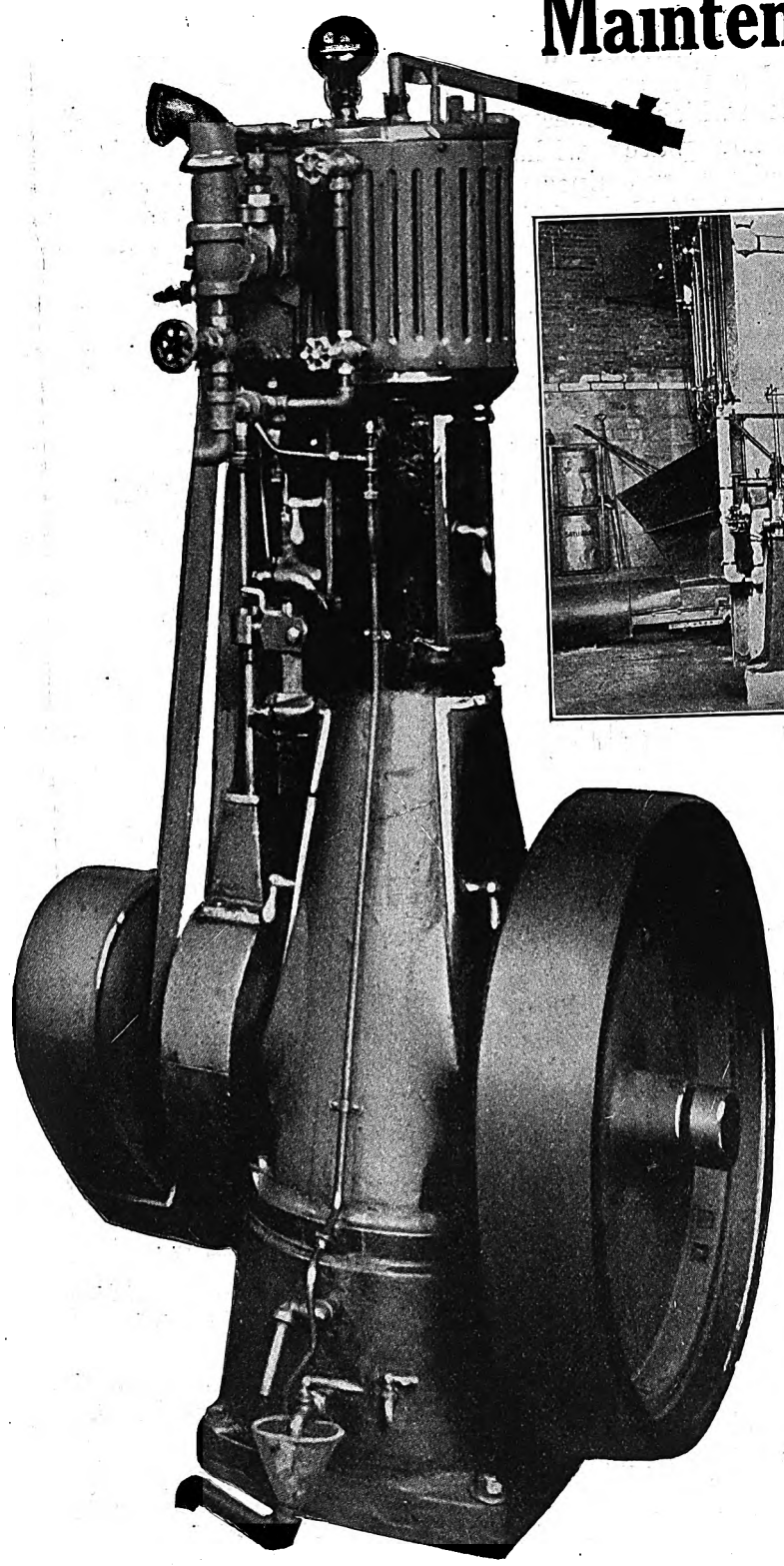
Lewis-Shepard
BOSTON

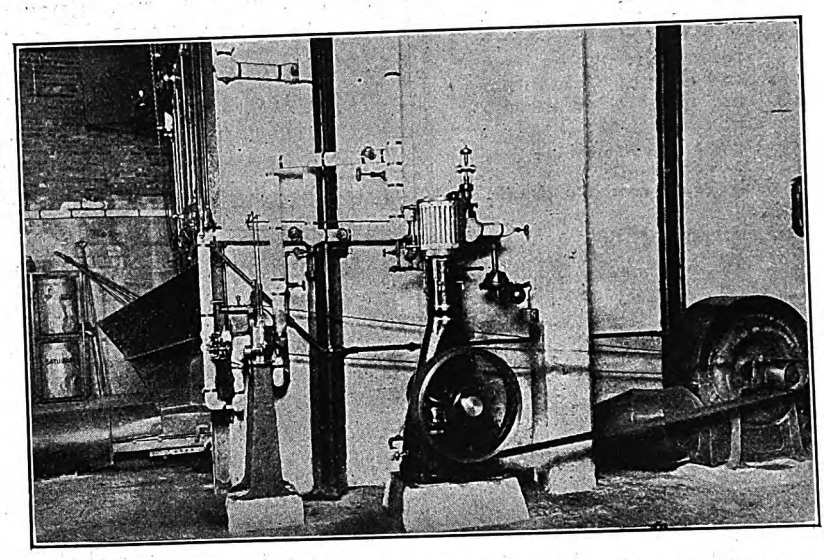
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of dirt, leaves and branches of trees. These may clog up the downspouts or leaders and cause an overflow or a leak during a storm. All roofs should be carefully inspected once a year and special attention should be paid to the area around the leaders and at the flashing. Roofs laid of many layers of roll roofing permanently cemented together and with a layer of slag or gravel on top should not require any maintenance. If they were well laid they are good for many years without attention. Tin roofs should be carefully inspected each year and any spots touched up. They should be painted all over at least every three years. Leaders on the outside of a building frequently freeze up in the winter. If this happens, a waste steam line can be turned into the leader under ground and this will keep it open. The newer types of buildings usually have leaders inside the building and of cast iron, and they last almost indefinitely. Steel tanks and their structural steel supports require painting at least every three years and it is best to inspect them each year, touching up any rusty spots. Rust will destroy quickly once it gets started and the cost of painting is saved on outdoor steel work quicker than anywhere else. The metal used for skylight frames is often galvanized iron and as this is thin it should be carefully watched and painted every year if necessary. Any cracked or broken glass can be replaced and the glass tightened up at the same time. Heavy wire glass is usually furnished for skylights and this should be protected by a heavy wire netting about a foot above the glass. Dust collectors and the suction piping leading to them are usually galvanized iron and may require painting every year but if it is not necessary to go over the whole surface, any rusty spots should be touched up.

The exterior of the buildings will require different treatments depending on the materials of construction. A concrete building can go a long while without painting if it was made of good materials and if the surface was well finished when it was built. The writer has known of comparatively new concrete buildings where the surface deteriorated in a few years. This could have been avoided by inspection of materials and workmanship at the time of construction or possibly by treating or painting the surface. Buildings on the street which are seen by thousands of people have an advertising value and should be kept in excellent condition even though part of the maintenance cost be charged to advertising. Buildings inside the factory plot, however, should not be neglected because they are not seen by outsiders but should be kept in repair as a conservation of an asset. Brick buildings laid with cement mortar should not require painting very often. In time the bricks may require painting, however. As practically all factory buildings are either concrete or brick, these are the only two which need be considered. If brick buildings are covered with ivy the vines should be cut back from the windows each year so they will not keep out light.

The Answer to the Power Maintenance Problem





If your choice is a Troy Engine you are at once assured of lowest maintenance costs, and long years of service under all conditions.

Many Troy Engine users know this is so.

A group of prominent stoker manufacturers made certain of Troy Dependability and Economy before they chose the Troy as standard equipment on stoker installations.

A Troy Engine requires hardly any attention because of its sturdy construction and exclusive features.

The Balanced Valve guarantees absolute safety. This valve is balanced except for sufficient pressure to hold its seat, yet operates freely and relieves the cylinder of any condensation.

There are many other advantages which will relieve your engineer of maintenance worries and help him operate his plant economically.

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Made in sizes from 2 to 200 B.H.P.

Troy Engine & Machine Co.
Troy, Pa.

TROY ENGINES

DEPENDABLE POWER with ABSOLUTE SAFETY

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sh needs painting every ree years and wooden sash quires about the same care. wooden sash are not tight, etal weather strips will make em so. The saving in coal ll pay for this in a few years. eds or blank walls can be ray painted and for this ge surface work it is eaper than hand work. Fire capes are so important that y should be inspected and sty spots touched up every ar and painted all over every o years. If they have a inging portion this should tested frequently. Bolts ding the fire escape to the ll should be tightened up ore painting and if any are se, larger bolts should be t in or bolts put in right ough the wall.

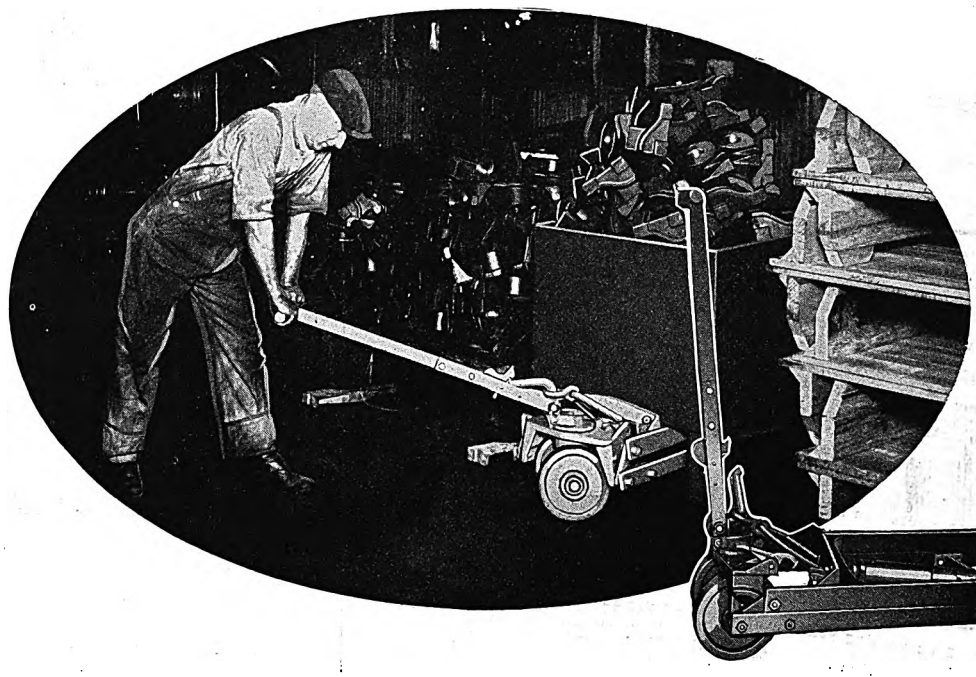
f trucking is done across factory yard from one lding to another, smooth crete truckways or walks necessary. If lift trucks used there should not be abrupt changes in grades they will cause the load to p. In order to keep these ks in good condition in the ter, they should be drained that frost won't get under heave them. In large yards roads are frequently made oncrete. However, crushed ck, well rolled, makes a good ory yard if trucking is not re. Holes in the crushed roads should be filled in as appear in order to keep in condition.

aintenance is an endless and in order to keep things ood shape, some system of ection is necessary. If a ial inspector is not avail- the foremen in the differ- departments throughout plant should report any ers coming under their ob- ation. A small form for purpose should be pro- and this will enable the tenance departments to ule their work to take of all regular repairs in order.

---

e reaction of the Euro- situation upon the Uni- States is definitely re- d in the decline of our ts to Europe. For the ending June 30, 1923, our t exports were 155,000,000 ls, as compared with 208,000,000 for the previous year. In that period our exports to Germany declined from $350,495,000 to $293,132,000. Exports of copper to Germany for the same period dropped 76 million pounds, and lead exports 13 million pounds. Germany's cotton purchases declined 45 per cent. during the same period and France and England also have reduced their cotton purchases.

Any further increase of political or economic troubles in the countries of Europe is certain to be reflected in decreased buying power on their part. Even France, which is at present, apparently, the most prosperous of the European countries is building up a mountain of debt and fixed charges which constitute an ever-increasing burden upon her people and a menace to their prosperity. More than two-thirds of her budget is now required to meet the interest on her three hundred billion franc debt, and additional borrowing of fifty billion francs is planned.—*The Guaranty Survey.*



The new Barrett-Cravens lift trucks are equipped with easy running Hyatt bearings because of the excellent service given by these bearings in previous models for many years.

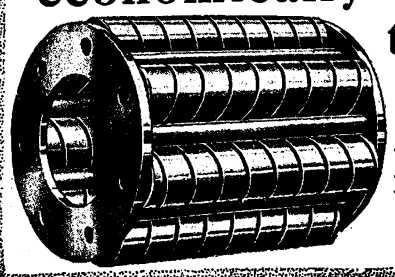
They Improved the Truck

But They Could Not Improve the Bearings

In designing their latest model lift truck, the Barrett-Cravens Company of Chicago, Illinois have improved many features but the Hyatt bearings that have given such economical service in Barrett-Cravens trucks for years are still standard equipment.

These easy running, self-oiling bearings need no attention except oiling three or four times a year and give satisfactory service throughout the life of a truck without adjustment or replacement.

To move your loads quickly, dependably and economically secure Hyatt bearing equipped trucks—it pays.

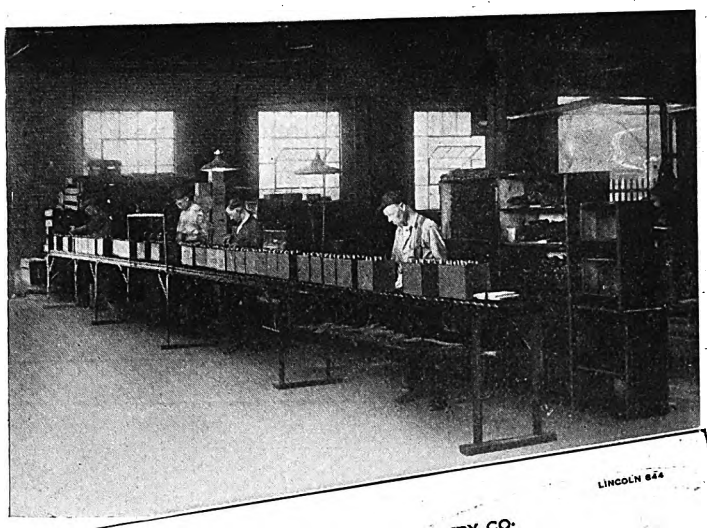


Hyatt Roller Bearing Company

Newark Detroit Chicago San Francisco

Worcester Milwaukee Huntington Minneapolis Philadelphia Cleveland Pittsburgh Buffalo Indianapolis

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LINCOLN 644

THE HAZELETT STORAGE BATTERY CO.
2133-57 COLUMBUS ROAD
CLEVELAND, O.

IN REPLY REFER TO

Sept. 12, 1923

The Alvey-Ferguson Company,
Cincinnati, Ohio.

Gentlemen:

We wish to express our appreciation of your engineering service.

Your conveying equipment has more than doubled our production per labor hour in our final assembling department and has saved us considerable investment.

All parts are now stored in the exact sequence of their use and unnecessary handling of our product has been eliminated. These facts contribute to the quality of workmanship.

I am sending you a photograph of our first line in operation after its installation.

Very truly yours,
THE HAZELETT STORAGE BATTERY COMPANY
C. H. Hazelett

CWH:HL

DOUBLES PRODUCTION

Two storage batteries manufactured where only one was made previous to the installation of ALVEY-FERGUSON Conveyors—that's the record of the Hazelett Storage Battery Company of Cleveland, Ohio. Just another instance of how

CONVEYING MACHINERY A-F TRADE MARK

Conveyors

are efficiently serving hundreds of different manufacturers.

There is no problem in internal transportation too complicated for A-F engineers. Their recommendations are cutting labor costs, saving unnecessary building operations and increasing productivity in almost every industry. An A-F engineer will make a survey of your plant without obligation.

THE ALVEY-FERGUSON CO., Inc.
CINCINNATI, OHIO

WRIGHT HOIST

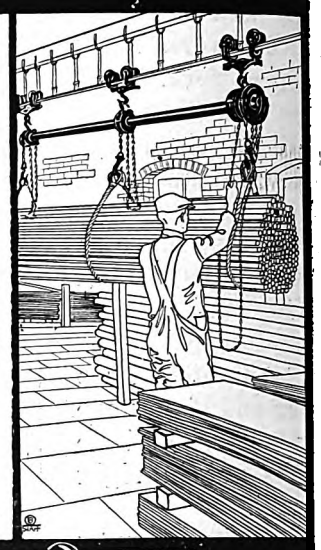
Lower production costs start with material and production handling efficiency.

It means the conservation of Time, Energy, and Man-Power.

Wright Hoists are built to accomplish unbelievable results in minimizing costs and raising efficiency to the maximum.

Give the Wright a chance to pleasantly surprise you.

What's your name? Address?



Lisbon, Ohio, U.S.A.

WRIGHT 1 TON

All the advantages of the Chicago District — at lower cost

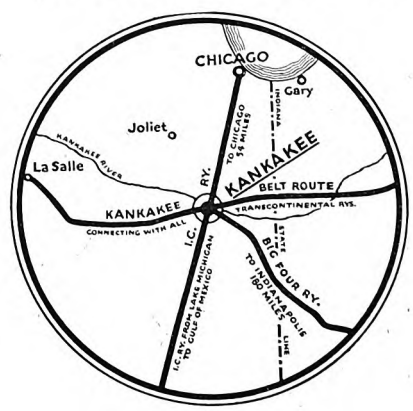
KANKAKEE
ILLINOIS

offers you all of the advantages accruing to a manufacturer located in the great midwestern market—and none of the metropolitan disadvantages.

Kankakee is a Chicago rate basing point. Coal mines a short distance away—low cost electric power—plenty of good gas at low rates—abundant skilled and unskilled labor.

Permit us to tell you more about our city by writing for the complete story on *Kankakee.*

J. N. SLETTEN, *Secretary*
CHAMBER OF COMMERCE KANKAKEE, ILL.



Kankakee offers you—

a factory site 50% to 75% cheaper than in large cities.

proximity to Chicago markets—90 minutes by train.

advantage of being in Chicago and Gary steel districts.

desirable living conditions for employers and employees.

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A Basic Industry in Our Biggest Territory

(*Continued from page* 21)

dark brown with a white ruff on neck and shoulders, although spotted or white animals are also fairly common.

Alaska has suffered for years from the ignorance of the people in this country concerning its possibilities. President Harding's recent visit should do something to dispel some of this ignorance because millions of people have had their attention attracted to the Territory who would never otherwise have given it a thought. In the first place it must be understood that while Alaska is not always as terribly cold as many people down here believe, the winters up there are generally pretty long; and the summers, though extremely hot, are not long enough to grow wheat or corn. Some vegetables and some grain are grown, but agriculture can by no means be considered a staple industry.

Alaska is a large country; it is larger than England, Scotland, Ireland, Finland, Norway and Sweden combined; and those countries have a total population of about 50,000,000. Alaska will doubtless never have as great a population as that, but it will some day contain a great many more people than it does now because it is a very rich country in natural wealth.

It contains gold and silver, copper and coal and a great many other valuable minerals. It also has wonderful fisheries, but the people will need other food. Of course food could be imported, as a great deal of it is—and probably always will be. But the great bulk of its meat supply will be raised at home; and here is where the reindeer comes in.

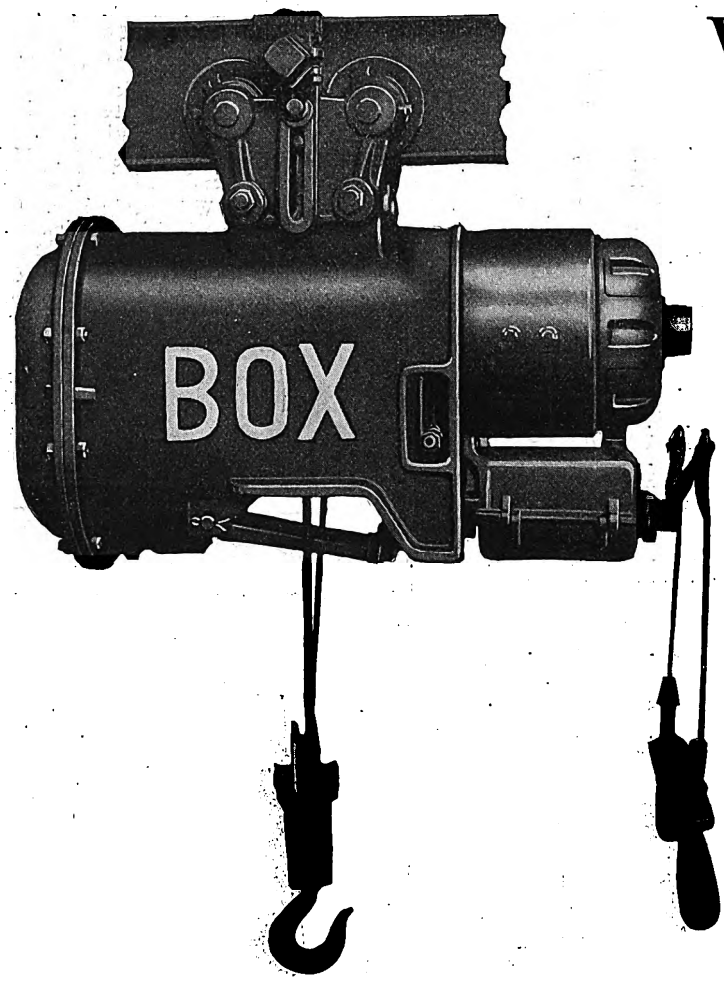
The reindeer is native to Arctic and sub-Arctic countries, and can forage for itself both summer and winter. The snowfall in the far north is very light somewhat contrary to general belief, and the reindeer does not mind the cold at all. Thus reindeer can be produced very cheaply. The land is suitable only for grazing. Practically the only expense is for herding—and two or three men can herd several thousand herd of reindeer. They can be driven long distances, feeding as they go, to the centres where the abattoirs are established.

The reindeer belongs to the same family as the caribou which is found by the million in Alaska and northern Canada. The reindeer is really a domesticated caribou. They have been domestic since before the dawn of history—in Europe and Asia—but not in America. The fact, however, that millions of caribou live comfortably in Alaska suggested the possibility of the introduction of the reindeer, and this experiment was first tried in 1892 when a few head were imported from Siberia. This was done by the Department of Education in order to render the Alaskan Eskimos less dependent upon hunting.

It had been noted that across the narrow Bering Strait the Siberian Eskimos were practi-

(*Continued on page* 73)

IT'S GOT TO BE DONE—BUT NO ONE WANTS TO DO IT



It makes no difference what the business, if there is lifting and shifting to be done, no one wants to do it.

LOAD LIFTER

GET THE FACTS TODAY. The amount of time required to get a barrel, a box or a casting off or on a wagon, or moved in the plant, is heart rending to the man who pays the bill.

If you are interested in wiping this burden out of your business and at the same time speeding up work and cutting labor costs—you will want our Bulletins and data on the "Load Lifter".

The "Load Lifter" has solved many lifting problems. It is small, compact, strong and powerful. It works fast and sure. Operated by electricity. A pull on a cord lowers or lifts. No skilled labor required. Only two gears and two pinions—very simple. All parts enclosed. Can be hung up in place, or installed on an I-Beam trolley any place—indoors or outside.

The "Load Lifter" is low in cost and high in efficiency.

- Automatically lubricated from one point.
- Working parts operated in bath of oil.
- Positive Forced Feed Lubricating System reaching all points.
- Totally enclosed construction.
- Hyatt Flexible Roller Bearings.
- Ball bearing motors.
- Forged Steel Heat Treated Stub Tooth Spur Gears.
- Manganese Shafts.
- Nothing to adjust.
- Perfect control.
- Small—but very powerful.
- Adjustable Trolleys.
- Interchangeable Upper Hook and Trolley.
- Permanently aligned bearings.
- Simplified Roper Anchorage.
- Extremely accessible.
- Interchangeable parts.
- Every bolt a fitted bolt.
- Fine workmanship throughout.

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ALFRED BOX & COMPANY, INC. PHILA. PA.

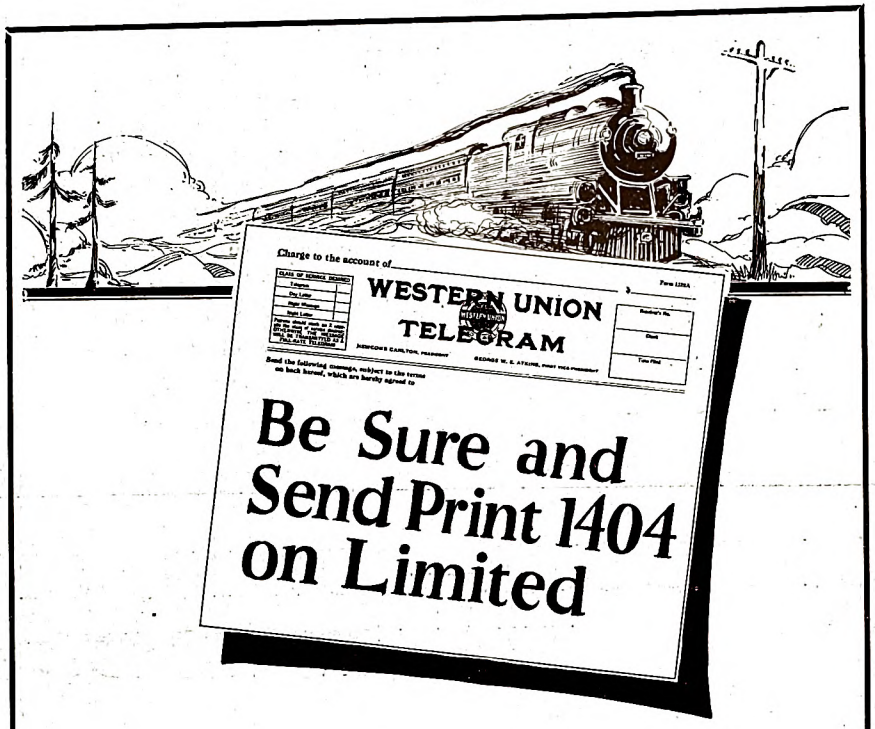
BOX CRANES

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The ELECTRIC "LOAD LIFTER"

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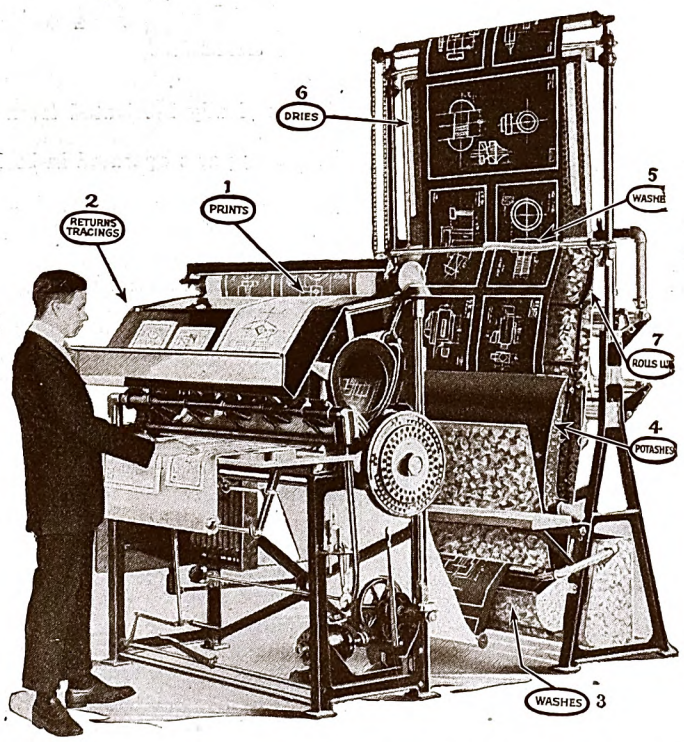
15 Minutes to Go!

An important contract depends on getting the print thru to destination on time!

But the trusty Pease Peerless Blue Printer helps out in the emergency—prints, washes and dries in one operation this important piece of paper in less time than it takes to write the note that accompanies it.

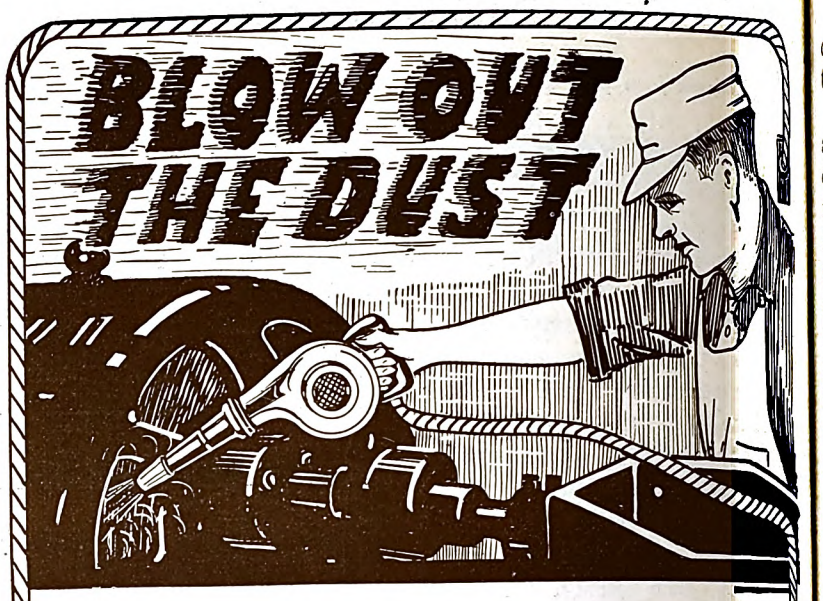
Pease Equipment has saved the day for many an important contract.

Why not investigate this machine, which is considered so essential in manufacturing, engineering and architectural offices?



Our new catalog explains the machine in detail
Just ask for Catalog M-28

THE C. F. PEASE COMPANY
828 N. FRANKLIN ST. CHICAGO, ILL.
"Largest Manufacturers of Blue Printing Machinery"



With a **CADILLAC** Portable Electric **BLOWER**

The handiest and most practical blower for blowing dust and dirt out of armatures, field coils, switchboards, machinery, line shafting, stock bins, shelves, etc.

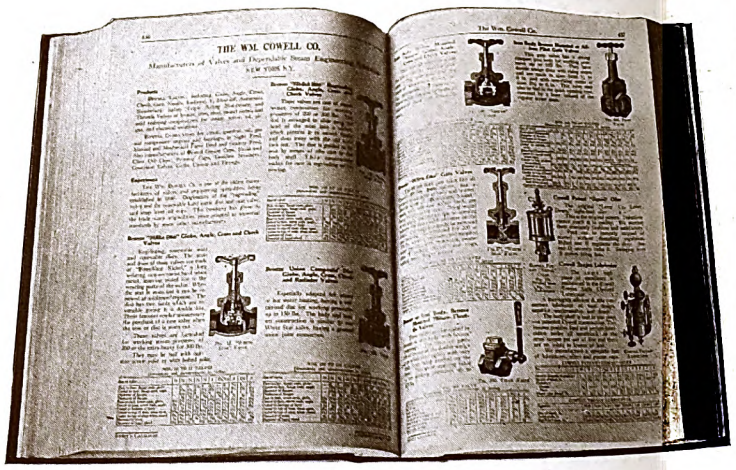
Lowers fire risks. Makes more healthful working conditions. Reduces depreciation in electrical and other machinery.

Weighs only 6 lbs. Complete in itself and requires no expensive installation or equipment. No condensation as with compressed air. Attached to any light socket.

The CADILLAC BLOWER has proved its worth and is performing successfully with hundreds of uses in shoe factories, cotton mills, grain elevators, coal mines, engravers, printers, wood working plants, textile mills, box factories, and every line of industry.

Write for descriptive folder giving prices and testimonials by leading manufacturers.

CLEMENTS MFG. CO.
Manufacturers of the Cadillac Electric Vacuum Cleaner
612 Fulton Street, Chicago
Canadian Factory: 76 DUCHESS ST., TORONTO.



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INDUSTRIAL and POWER PLANT MATERIALS and EQUIPMENT

See SWEET'S ENGINEERING CATALOGUE

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(*Continued from page 71*)

ally independent because of heir reindeer herds.

In the decade between 1892 nd 1902 a total of 1,280 rein- eer were imported. Today here are over 260,000 head in laska; and in the interval hore than 125,000 have been laughtered for food. And hus from the semi-philan- hropical experiment of 1892 as developed an industry hich seems destined within a ew years not only to supply laska with its principal meat equirements, but also to aug- nent the fast-diminishing eat resources of the world. or as population increases he range areas of the world ust decrease. When land be- omes too valuable for pas- ure the production of meat an- nals must necessarily be re- uced.

It is estimated that the graz- ng areas of Alaska will sup- ort 4,000,000 reindeer. This ill allow of an annual laughter of 1,000,000, which at n average net weight of 150 os. a carcass will produce an- ually 150,000,000 lbs. of meat.

In this regard Dr. E. W. Nel- on, of Washington, D. C., hief of the U. S. Biological urvey, who formerly lived for number of years in Alaska, nd has seen the industry de- elop from infancy, says:

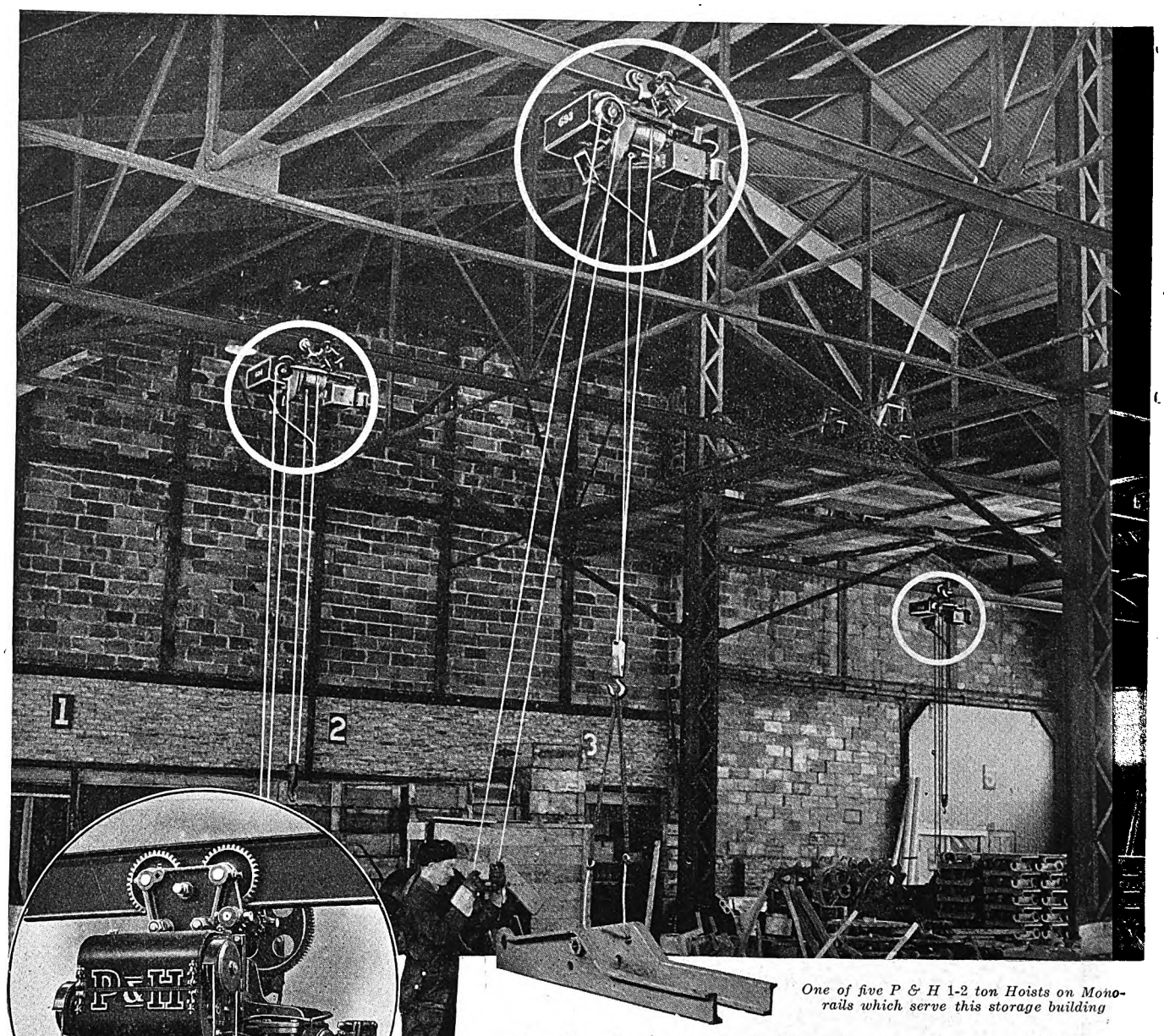
The stock (cattle) growing resources of Alaska are lim- ited, owing to the climatic conditions, and the reindeer industry will become its most extensive and valuable meat producing resource. It will supply the demands of the Territory and yield a great surplus for exportation to the United States. The fine quality of reindeer meat will be quickly recognized and I predict it will be welcomed throughout the country as a valuable addition to our food supply.

The regulations governing he importation of reindeer nto Alaska were made very trict. Reindeer could only be nported by the government nd for the use of the Eski- os. The latter were prohi- ited from selling female ani- als; and in that way it was oped that reindeer raising ould remain an Eskimo mo- opoly.

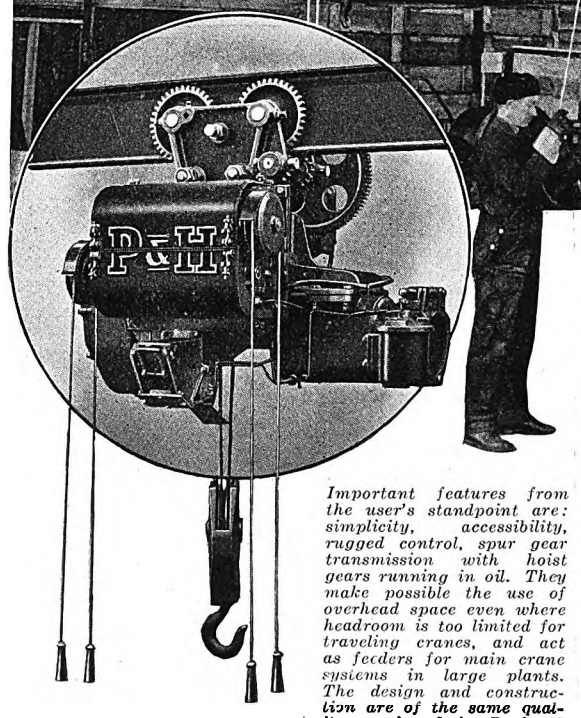
The Eskimos, however, were ot accustomed to caring for nimals. The reindeer needs very little attention but it does require some; and this the Eskimos were not capable of giving. To meet this contingency the department imported a number of Laplanders and their families to act as instructors. As payment for their services the department supplied these Lapps with small herds of reindeer which they were to handle on a share basis. The Lapps, however, not being wards of the government like the Eskimos, could not very well be prevented from selling their own share of the increase, and in the course of time there grew up in Alaska from this source a number of large independent herds.

Most of these privately owned herds were bought up, however, by Lomen & Co., of Nome, the pioneers in the commercial reindeer industry. This company was formed in 1914 for the purpose of exporting reindeer meat (leaving the local field to the Eskimos as well as providing a market for the latter's surplus supply).

Last year the Lomen



One of five P & H 1-2 ton Hoists on Mono- rails which serve this storage building



Important features from the user's standpoint are: simplicity, accessibility, rugged control, spur gear transmission with hoist gears running in oil. They make possible the use of overhead space even where headroom is too limited for traveling cranes, and act as feeders for main crane systems in large plants. The design and construction are of the same quality as found in P & H Traveling Cranes—depend- able service and low main- tenance are the result.

Reducing Labor Costs in Storage Sheds

Reducing the number of men required in storage sheds—releasing them for other work—is but another of the many ways in which P & H Hoists help to meet present day labor shortage.

P & H Small Hoists are used for loading, unloading and placing materials, the main monorails or spurs extending to various departments and parts of the plant as required.

They may be installed in buildings already erected. Utilizing overhead room, but little aisle space is required—only enough for the operator in traversing under the monorail. The hoisting speed of the P & H ½-ton hoists installed in the storage room above is 23 feet per minute loaded and 46 feet light.

Crane and Hoist Division

PAWLING & HARNISCHFEGER COMPANY

Established in 1884

3850 National Avenue, Milwaukee, Wis.

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P&H ELECTRIC HOISTS

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company shipped about 2,500 carcasses, and through its efforts a new table delicacy has appeared on the menus of the higher-priced restaurants and hotels throughout the United States. I say higher-priced because as yet the available supply is so small in comparison with the demand that naturally a high price can be obtained. Yet eventually it should be relatively cheap, as the cost of raising reindeer is very low as compared with cattle or sheep.

The Lomen company's herds now number about 45,000 head, and as the herds double in numbers every three years, some idea may be obtained of the rapidity with which this industry can develop. As the adult males are butchered each year they are shipped in cold storage to Seattle and trans-shipped to New York. This is a considerable haul, but even so it is not so long as the trip which an Australian mutton chop or an Argentine steak must make.

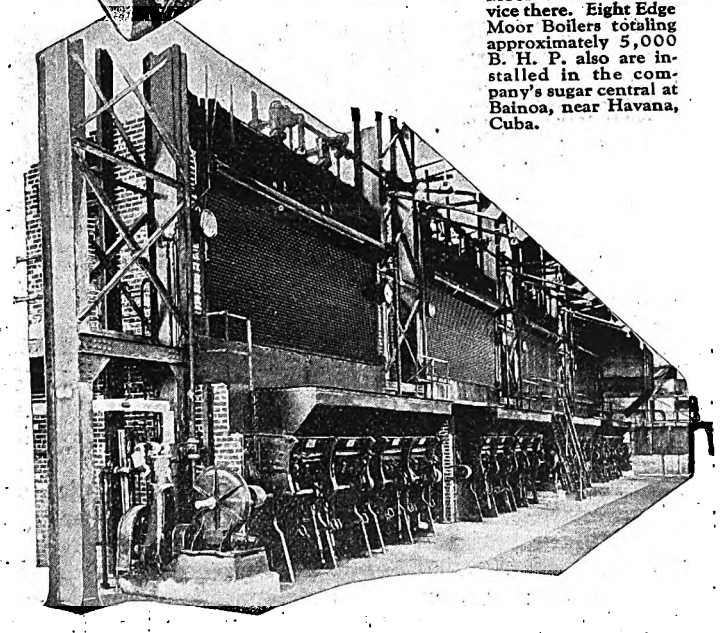
The reindeer industry has grown so quickly out of nothing that the resources of the Lomen company were strained to the utmost to keep up with it, and a few months ago Carl Lomen, one of the sons of Judge Lomen, and the general manager of the company, went to New York to seek greater financial accommodation than was possible at Nome. He has recently returned north after having secured the financial co-operation of a group of wealthy and influential New Yorkers, among whom are the Dukes, the great tobacco people, and one of the sons of the late Colonel Theodore Roosevelt. And so far as Alaska is concerned the reindeer industry is off to a flying start.

In Canada, too, where the area available for reindeer grazing is estimated to be about ten times as great as in Alaska, reindeer-raising is being undertaken. Vilhjalmur Stefansson, the famous Arctic explorer, has been chiefly instrumental in its development in the Dominion. He secured the grazing rights of about 113,000 square miles of land in Baffin Island from the Canadian government and has been successful in enlisting the interest of the great Hudson Bay Company, the pioneer in northern trade for 250 years, and they are now importing reindeer from Norway to form the nucleus of their herds. They also expect to incorporate a certain percentage of caribou into their herds, as they are larger than the domestic animals and better adapted to the country.

Now as to the quality of the meat: Those who have eaten reindeer meat as a steady diet for any length of time generally refer to it as the finest meat in the world. In Norway a great deal of beef was once imported, but reindeer meat has since displaced a considerable proportion of it—not altogether because of the cheapness of reindeer meat, but because the people generally prefer it. It has all the juiciness of beef with the delicacy and flavor of venison. Carl Lomen compares it to breast of mallard, and that description comes nearest to fitting the impression left upon my own palate.



The model plant of the Hershey Chocolate Co. at Hershey, Pa., showing new power plant at right and (below) four 750 H. P. Edge Moor Boilers in service there. Eight Edge Moor Boilers totaling approximately 5,000 B. H. P. also are installed in the company's sugar central at Bainoa, near Havana, Cuba.



DURING the past ten years the Hershey Chocolate Company has installed twenty Edge Moor Boilers, totaling more than 12,000 B.H.P., in its model plant at Hershey, Pa., and its sugar central at Bainoa, Cuba.

These boilers represent five separate orders—the first placed in 1913, the latest in 1923. The performance of the first Edge Moor Boilers at Hershey resulted in their selection for the new power plant built in 1920, and for the Cuban mill.

In the confectionery industry, as in a score of others, Edge Moor users are among the representative leaders.

The Edge Moor catalogue details the advantages of this boiler that have won it preference among discerning purchasers. We shall be glad to send you a copy.

EDGE MOOR IRON COMPANY
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EDGE MOOR BOILERS
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EDGE MOOR Water Tube BOILERS

FOR INCREASED FUEL ECONOMY

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DO YOUR OWN THINKING

"Many plant executives whose minds are centered upon the primary purpose of production overlook or fail to appreciate the intimate relationship between production, manufacturing profits and maintenance."

From an editorial in Industrial Management Oct. 1923

It is not uncommon to find plant executives wedded to the idea that as long as production is maintained undiminished, that all is as it should be.

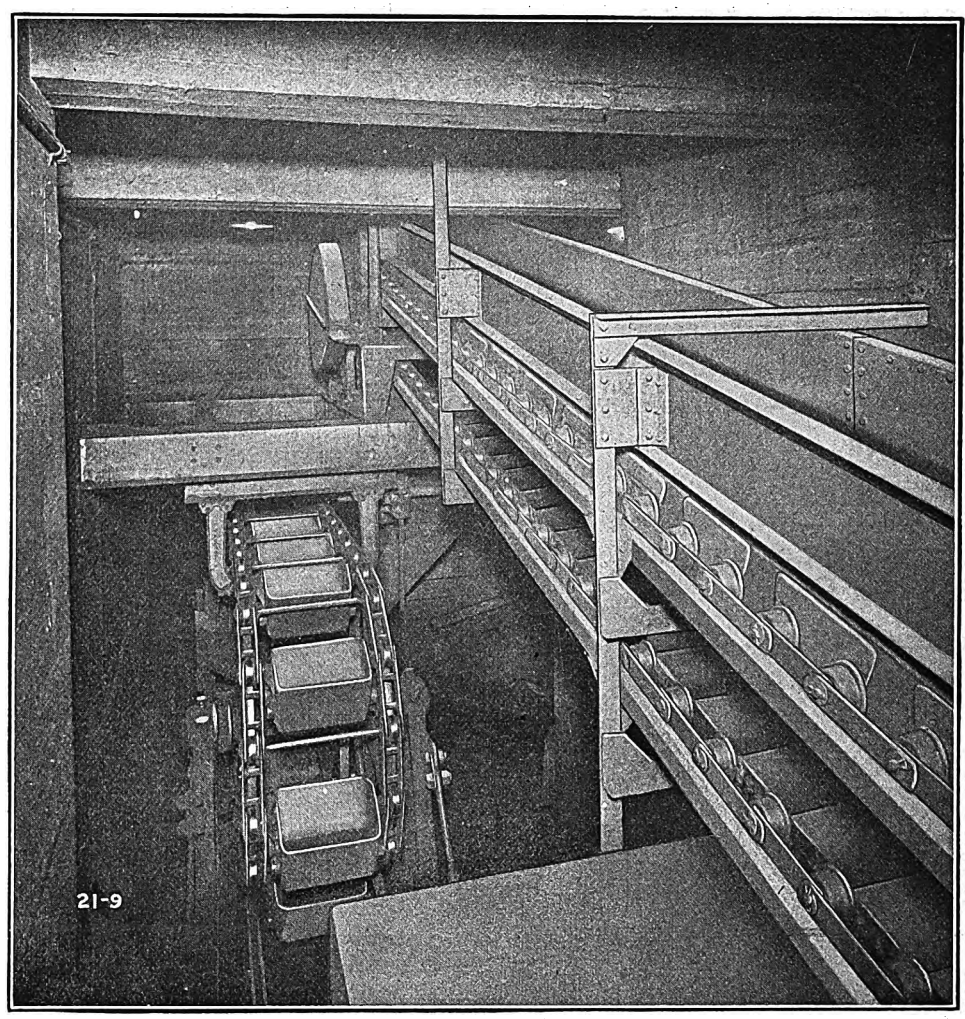
They rarely trouble themselves about the *cost* of production; resting contentedly in the doubtful security of their *book costs,* while abnormal costs —unduly apportioned—are stealthily eating away the profit.

But these slip-shod methods cannot continue, if profit is to be made and volume production maintained. The executive must *think for himself* and learn *why* his profit is not commensurate with the cost of manufacture. He must probe deep into his costs and segregate the *actual* from the *superficial.*

For example—in the matter of coal and ashes handling and rehandling. They may fail to note that inadequate apparatus is an expensive burden, which must be accounted for somewhere between the receipt of coal and the finished product. But, if they probed deep enough, they would find the loss of time for shutdowns, cost of frequent repairs and slowing-up of production will soon bring them to a realization of this fact.

On the other hand, Hunt Coal and Ashes Handling Equipment that has been carefully planned to meet not only existing needs, but to provide for future expansion as well, will prove a profitable investment and overcome in no small degree the handicap imposed on the initial cost of production by faulty or inefficient mechanism, or manual labor.

Hunt engineers, whose specialty for over half a century has been the economical and safe handling of bulk and manufactured materials in every industry, can, after a critical survey of your plant, undoubtedly suggest a remedy for existing evils or make recommendations for an entirely new layout that will cut time, labor, operation and maintenance costs to the minimum.



Hunt Apron Conveyor feeding into Pivoted Bucket Conveyor through Coal Cracker (not visible)

Hunt Pivoted Bucket Conveyors consist of a series of independent swinging buckets, free to dump in either direction. Conveyors can run in any direction, the buckets hanging in an upright position; therefore dry or liquid material can be handled without spillage.

The peculiar system of driving by pawls (of which the Hunt is the ONLY *type existent), relieves the wheels of all stress. The Hunt conveyor can assume twists impossible with a sprocket driven machine.*

WE DESIGN AND BUILD:
Conveyors, Skip Hoists, Coal Crackers, Weighing and Measuring Devices, Industrial Railways, Automatic Railways, Cable Railways, Electric Vibrating Screens, Cut-off Valves or Gates, Cars, Tracks, Switches, Motor Cars, Scales, "Stevedore" Transmission and Hoisting Rope.

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Watching the Pulse of the Power Plant

(*Continued from page 17*)

ditions. Where such repairs are excessive, steps should be taken to adjust operating conditions in the right direction. Pressures in the fire box are not unusual, but they have a disastrous effect upon the fire brick lining. In many cases they force the hot gases into every crack and crevice, gradually weakening supporting ironwork until it falls in, and a costly repair job is in order.

Stoker maintenance is also closely related to plant operation. A high-sulphur coal, with a low fusing point ash, is the enemy of all grates and those stoker parts exposed to the heat of the furnace. Under such conditions, high boiler ratings are not possible without excessive replacement charges. The forcing of the boilers produces a high furnace heat that melts the ash fusing it readily with cast iron. Where high ratings are necessary care must be exercised in the selection of a coal that is suitable to the operating conditions. If it is impossible to get a better grade of coal, sufficient boilers should be added to carry the load at reduced ratings, or grate and stoker repair costs will be abnormally high.

Feed waters heaters require regular periodic cleaning to get the full benefit of the heat in the exhaust steam and to maintain a high temperature of the water entering the boilers. A gradual decrease in the feed temperature indicates a fouling of the heater, causing a loss of one per cent. in efficiency for every 10 degrees drop.

The importance of the proper maintenance of steam piping is not always appreciated in the average industrial power plant. The correct installation and anchoring of steam lines is a factor that has much to do with their subsequent upkeep. Excessive vibration opens up the joints, causing leaks and requiring gasket replacements at all too frequent intervals. Sharp right angled bends in main steam lines are apt to aggravate the pulsating effect produced by a large reciprocating steam engine, thereby causing vibration and gradually weakening the line. The installation of a large receiver at the engine acts as a steam reservoir, tends to absorb these pulsations and minimizes vibration.

The care and maintenance of engine room equipment are of equal importance with that of the boiler house, since unnecessary shutdowns materially affect the production of the entire plant. There is perhaps one essential difference between a shutdown of the boiler house and a similar shutdown in the engine room, which might give the boiler house a slight preference in the matter of first importance. When the engine room is out of commission, the lights and power throughout the plants are temporarily discontinued, but when the boiler house stops work the engine room can't run and there is neither light, power, heat, nor steam for the many cooking and other pre-

In the New Hotel Statler, Buffalo & Union Trust Bldg., Cleveland

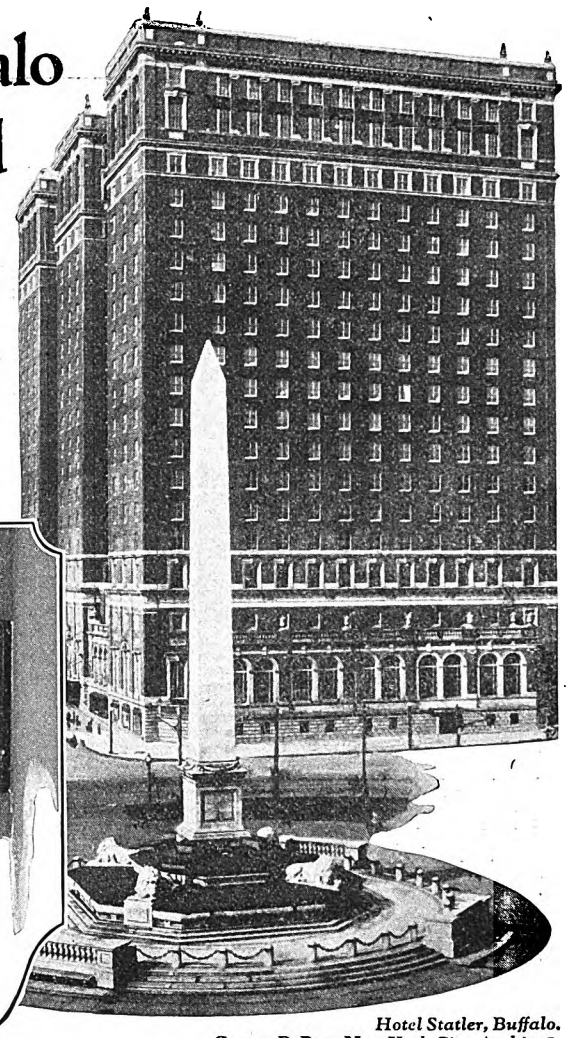
Ventilating fans, compressors, refrigerating machines, pumps, and other motor-driven machines in modern buildings are now controlled by Cutler-Hammer Standardized Building Type Controllers.

The starting and speed regulating parts as well as main line switch and overload protection are enclosed in one safety cabinet—incorporating the ideas of leading architects and engineers, the requirements of the National Electrical Safety Code, municipal and state codes, and the Electric Power Club.

A standardized line of this type, the result of years of development work by the Cutler-Hammer engineering force, eliminates the added cost of special controllers. In the enclosed types the incorporation of main line switch and overload protection makes for better appearance, reduced installation expense, less wiring, fewer conduit fittings, and greater safety. The "C-H" trade mark identifies this standardized line.

An 8½x11 booklet has been prepared for use by architects with material arranged for ready use in writing specifications. Let us send you a copy of "Electric Control Specifications for Building Equipment."





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George B. Post, New York City, Architect.



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C-H CUTLER-HAMMER
BUILDING TYPE CONTROLLERS
FOR STARTING AND SPEED REGULATION OF ELECTRIC MOTORS

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esses. All energy in the plant s stopped.

Furthermore, engine room roubles are usually audible nd are detected by the sound roduced, or indicated by suitble gages provided for the urpose. Boiler room troules often develop within the oiler shell, in the furnace or n some equally well-obscured ocation, unseen and unheard, until they make their presence elt in the form of a complete hutdown.

Engine room troubles must ot be minimized, however, imply because they give their istinctive warnings. Once he warning is given, it is not lways easy to locate the seat f the trouble. Nor is it alays a simple matter, after the rouble is located, to apply he remedy.

On every well-designed enine there are many parts that equire regular inspection. he assurance of efficient and eliable operation of the unit epends upon the proper functioning of its vital parts. The iling system and all oil leads, ucts and holes must be kept pen and free. No lubricated art must be allowed to run ry. Insufficient oil is indiated by heating of the bearngs. They may even smoke, ut if the condition goes unnoced, the bearing will become o hot that the babbitt metal ill run out and the engine is own for repairs.

Gland packings should be ept tight enough to prevent akage. If they are too tight, owever, they increase the friction load of the engine and may ven score the piston rod, makg it impossible to stop leakge. Excessive leakage means orn or faulty packing, which ould be replaced at once.

Piston rings must be a perct fit in the cylinder or they nnot maintain a steam tight al. Leakage by the piston ngs causes power losses and sults in excessive steam conmption for the horse-power veloped.

Lost motion due to loose ints in the valve gear, conecting rod bearings or elsehere, makes its presence own by a distinct knocking. his looseness should be taken to prevent excessive wear d irregular operation.

In a turbine plant the most tal parts requiring attention e the main and thrust bearings. These units operate at very high speeds and bearing trouble develops in an incredibly short time, if operating conditions are unfavorable. The lubrication system of the turbine is its vital spot and must be absolutely free from foreign matter and clear at all times.

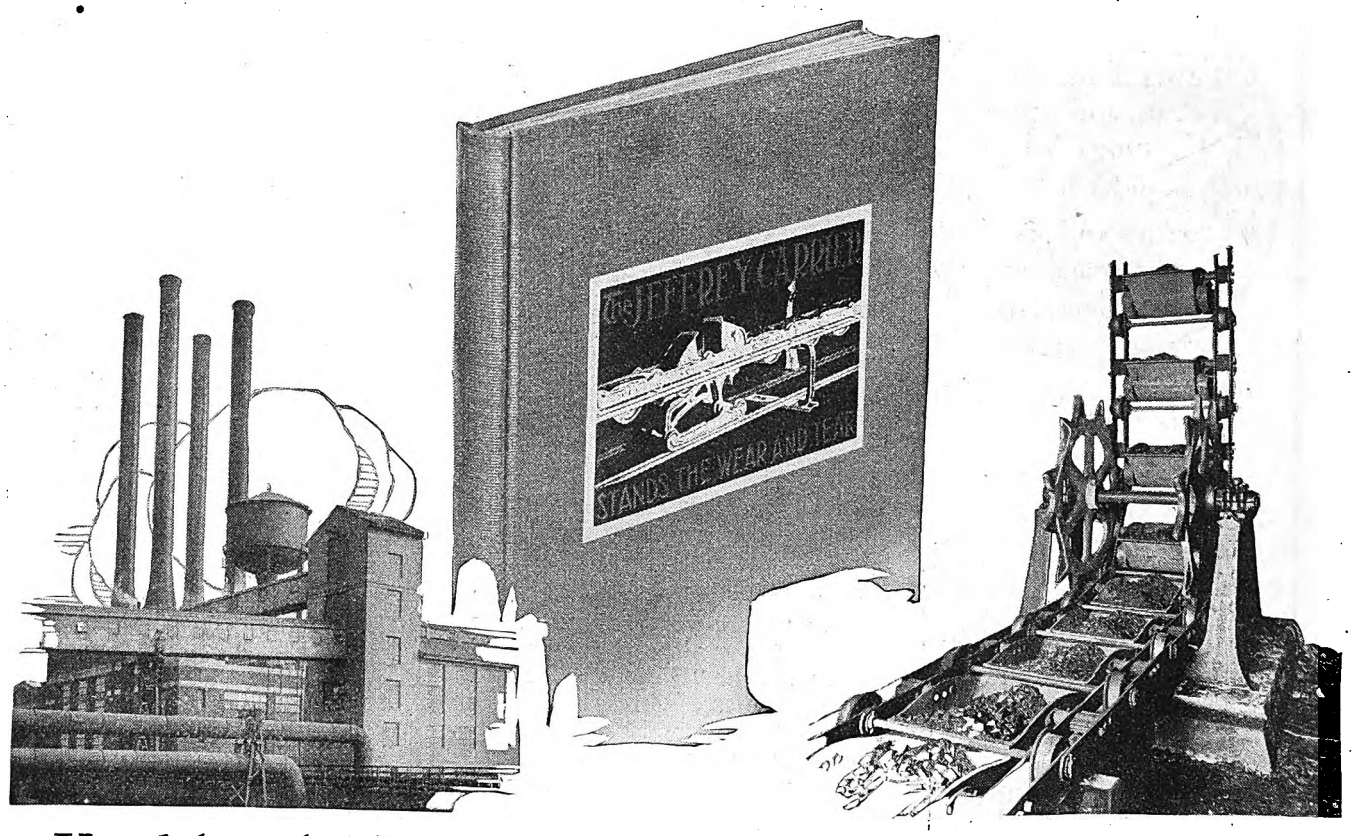
Turbine auxiliaries, however, usually require more attention than the turbine itself. The auxiliaries include condenser pumps, vacuum pumps, circulating pumps, etc.

The most usual engine room trouble is a hot bearing, due either to incorrect adjustment, improper alignment, poor oil or too little of it. When the bearing becomes too hot the journal cuts into the bearing metal, small bits of which fill the bearing clearance and increase the heating effect by their friction.

Cylinder heads are sometimes cracked by the admission of large slugs of water into the cylinder with the live steam. Such accidents are

(*Continued on page 79*)

The JEFFREY— Pivoted Bucket Carrier



Used by the Leading Manufacturers of the World

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LEADING Industrial Engineers recognize the Jeffry Pivoted Bucket Carrier as the highest type, most efficient and dependable Coal and Ashes Handling Equipments.

The design, workmanship, and special methods used in the construction of this Carrier give assurance of proper performance and long life.

No mechanical loader required with the Jeffrey Carrier. The over-lapping lips of the buckets permits a continuous stream of materials to be discharged onto the Conveyor. Many advantageous features and illustrations are contained in Catalog No. 210-S.

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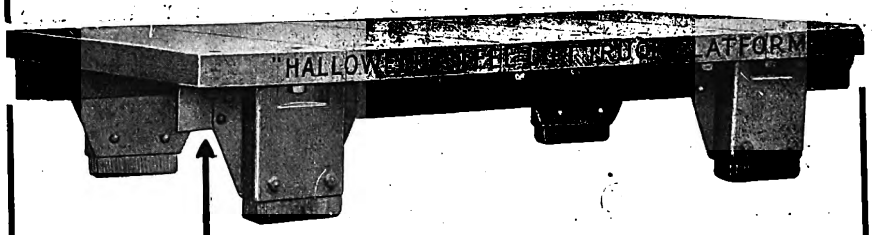
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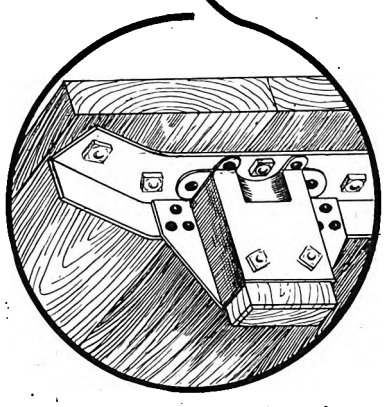
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STEEL LIFT TRUCK PLATFORMS





Hydraulically driven rivets, instead of bolts, hold the steel leg supports to the runners.

Riveted Hydraulically Not Bolted

Don't overlook this when comparing platform values.

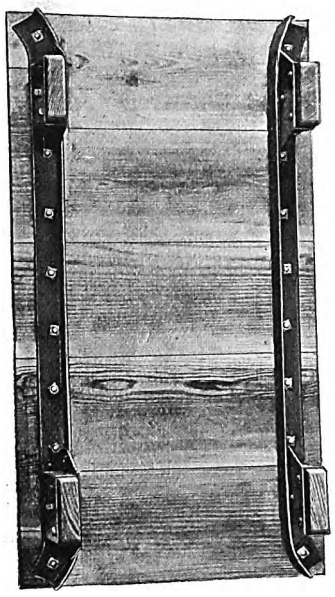
No amount of bumping and hard knocks can loosen the steel legs from the runners. Ordinary bolts soon work loose and increase maintenance costs considerably. Hydraulically driven rivets eliminate the possibilities of them working loose.

This is only one feature of the rugged design of "Hallowell" lift truck platforms.

There is the substantial platform top, the wooden legs set on the end of the grain and the special design of the "Hallowell" curved steel runners, which allow lift trucks to slide under easier without damage to sides, no matter from what angle the lift truck hits the platform.

The "HALLOWELL" is made in three different types—"A," "B" and "C"—resulting in a very complete line and providing for a suitably constructed platform for any purpose.

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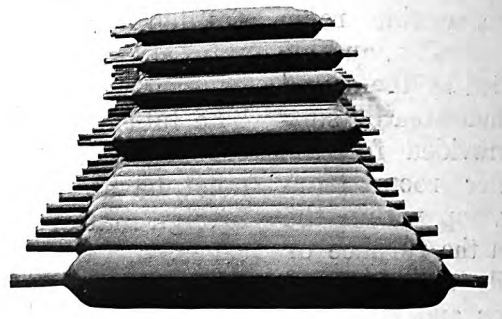
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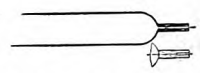


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Whenever rollers are used, Conveying Systems, Steel Mill Tables, and the like, maximum neck-strength is required because here the strain is most severe. Wharton rollers are made in one-piece—not welded. They are well balanced, and on account of shape when necked down maximum strength is obtained.

Yet, because they are hollow they are light in weight—saving in freight—easy to handle—lower power cost. Built only on order to meet customers requirements. Submit your problem to us—send sketch or blue print and give dimensions required.

We are also manufacturers of short lengths of large sized seamless tubing to fit unusual conditions. The manufacturing experience of our several plants is at your disposal.



Cross-Section Showing Hollow Construction

Wm. Wharton Jr. & Co., Inc.

(Founded 1859)

30 Church Street, New York, U. S. A.

Cable, Whilwharton, New York



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(*Continued from page 77*)

prevented by properly draining the cylinder and steam line before starting up, and by the installation of suitable separators in the steam line where it enters the cylinder.

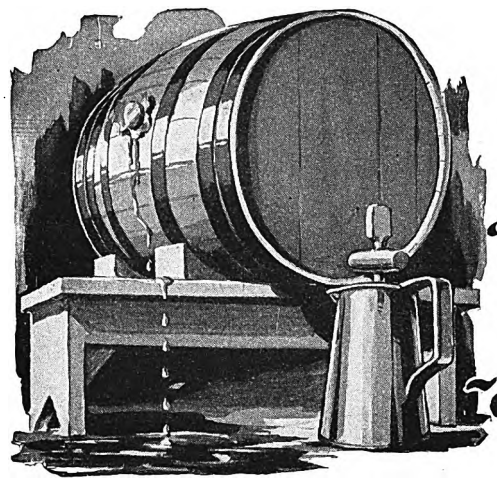
The loss of production from a shutdown or stoppage in the engine room may so far exceed the cost of proper maintenance, or even the cost of power, in many cases, that almost any reasonable expense is justified if it will result in keeping the engine turning during the working hours of the plant.

The steel industry reflects, perhaps as clearly as any other, recent irregularities in business trends. Production, as in most lines of manufacturing, has declined from the peak reached earlier in the year. Average daily output of ingots in September was 132,534 gross tons, or 16 per cent. less than in April, but greater than in any month in 1922. Unfilled orders of the United States Steel Corporation have declined in greater degree—32 per cent. from March 31 to September 30. Prices of steel on the whole, however, have remained practically unchanged since April.

As regards the volume of domestic demand in 1923, the steel industry has occupied an especially favored position. It is generally recognized that the building and automobile industries were outstanding factors inducing the remarkable expansion of general business in the early part of this year. A third important factor has been the program of the railroads for upkeep and for expansion of equipment.

These have all directly enlarged the market for steel products. Moreover, the extraordinary requirements of the petroleum industry for piping and tanks, as well as the uses for steel in the vast road-building programs in many sections of the country, have furnished additional outlets for the products of the steel mills. Particularly in the building and transportation industries, deferred demand has represented a significant addition to current requirements. Shortages had developed during the war and the subsequent period of depression.

The distribution of steel in 1922 among the chief steel consuming industries gives an indication of the relative importance of these industries in the markets for this commodity. According to estimates by The Iron Age, the principal consumption of finished steel by industries, expressed in percentage of total rolled steel production, was as follows: railroads, 22 per cent.; buildings and other construction, 15 per cent.; automotive, 10 per cent.; and oil, water, gas, and mining, 10 per cent. Experts accounted for 7 per cent. of the total; the remainder, 36 per cent., representing consumption by a wide variety of industries. It is not to be assumed that last year's distribution was normal. Consumption by the industries, relatively as well as absolutely, varies greatly from year to year. In 1921, for example, when the production of finished steel was greatly below that in 1922, the railroad and automotive industries each took only about one-half as much of the output proportionately as in the latter year.—*The Guaranty Survey.*



"The Saving at the Spigot and the Waste at the Bung"

The manufacturer who buys shipping boxes upon "price" alone invariably pays the biggest premium.

TOO often, low price is the paramount factor in the selection of the shipping box. Those greater costs that pile up later, in damaged shipments and broken goods, are seldom reckoned—or if reckoned they are passed over as expense that cannot be helped.

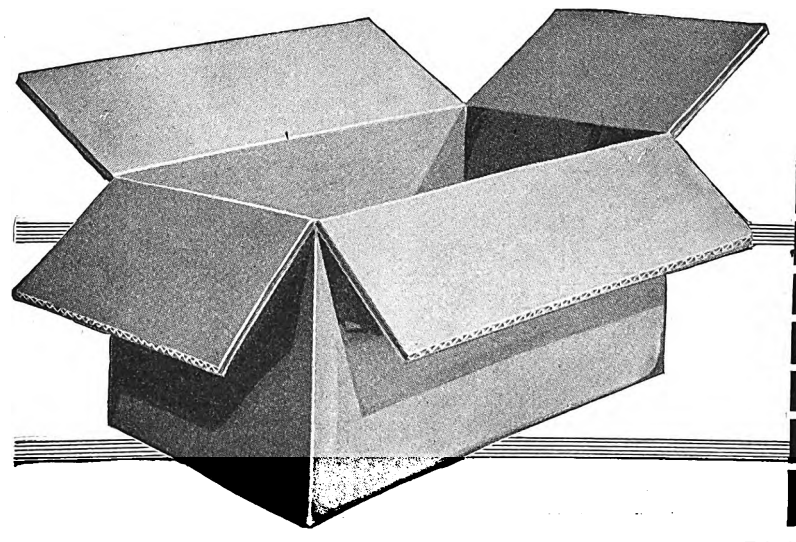
Do not be blinded to the "big leak" when buying your boxes. Let their protective quality, their fitness to carry and safeguard your goods, rather than their low price, be the primary consideration. With the *right* type of box, transit losses are eliminated and the initial cost of the box is your last and only expense.

Built always to a strength equal to the task they are to perform, H & D Boxes are at once the practical and economical shipping containers for thousands of divers products. Breakage and damage losses are reduced, by their use, to an absolute minimum. They are lightweight for freight saving; they are received "knocked down" for space-saving storage; they are instantly assembled for packing; they are easily filled and sealed. Mail the coupon for the story of these BETTER BOXES and the full details of our free box design service.

The Hinde & Dauch Paper Co.

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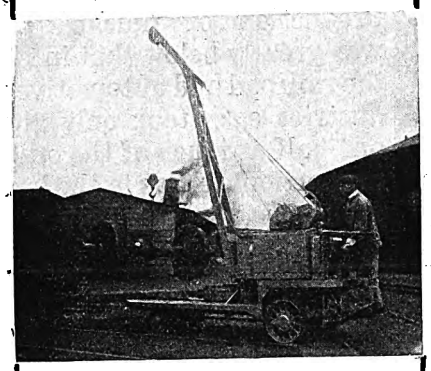
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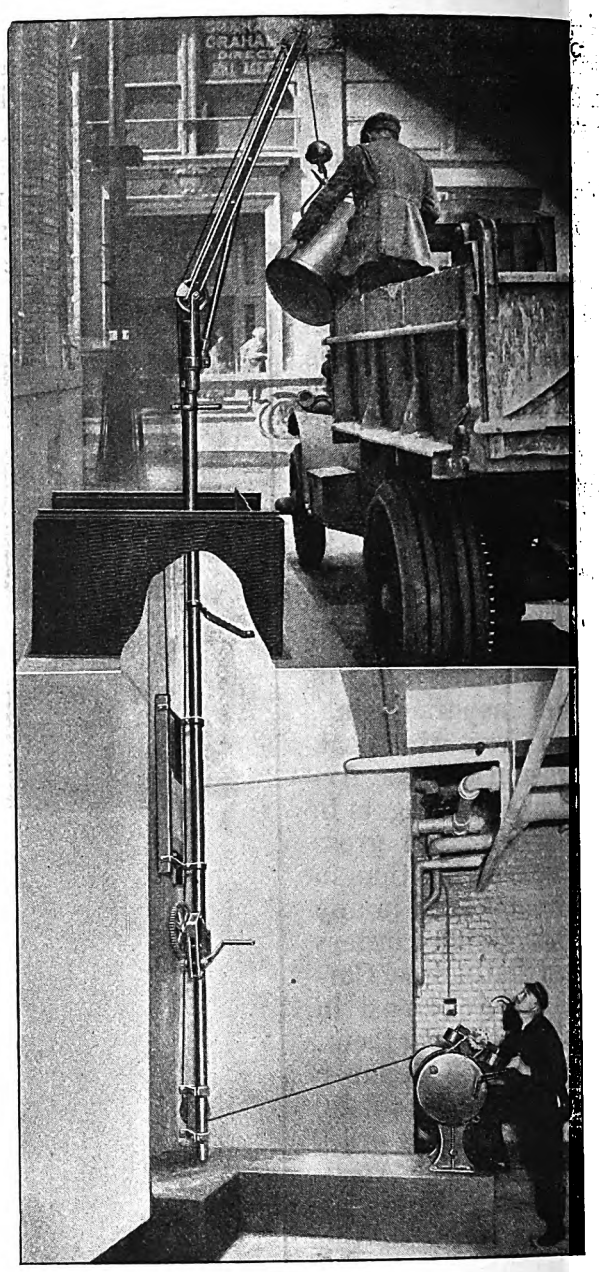
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Good Lighting and Prosperity

(*Continued from page 20*)

onditions indoors. Many researches have been conducted recent years with various bjects such as the elimination f glare and the consequent yestrain, the increase in the afety of the workman, the reuction of spoilage, and the inrease in production. The latst one conducted by D. P. Hess nd Ward Harrison[1] showed an ncrease in production of 12.5 er cent., on increasing the inensity of illumination from 5 oot-candles to 20 foot-candles. he important point is that is 12.5 per cent. increase in roduction was achieved at ly a small additional expense r lighting which was only 4 per cent. of the payroll. the series of experiments nducted there was a definite crease in production for very increase in the intensity illumination.

In many cases the lighting not only inadequate but so nproperly and inefficiently one that increase in production, lower spoilage and reater safety can be achieved merely rehabilitating the ghting system without inreasing its actual operating st. It is always surprising students of lighting that ankind will ignore such an portant factor as lighting. nd yet this is just what is beg done on every hand. A w years ago W. A. Durgin[2] nducted a series of tests hich showed increases in proiction as high as 100 per nt. when poor lighting was anged to adequate and oper lighting. In one case hen increasing the intensity om 3 foot-candles to 12 footndles a 10 per cent. increase production was achieved at increased cost of 1.2 per nt. of the payroll. In anher case an increase from 4 12 foot-candles increased oduction in various departents an average of 15 per nt. Such evidence is growg yearly and combining with is the philosophy of the earer paragraphs of this article e cannot avoid the conclusion at better lighting, which is rtainly needed from the andpoint of the welfare of workmen, will pay other large dividends to the industry itself in greater production.[3]

Of course, there are many factors influencing such researches so that to be conclusive they must be elaborate. Some of these have been conducted in an approved manner which gives weight to the evidence. But let us take the clearly defined process of reading. The writer has shown[4] that an average increase of 15 per cent. in the speed of reading black print on white paper resulted from an increase of the illumination intensity from 4 foot-candles to 16 foot-candles. When reading black print on gray paper the increase in the speed of reading was 50 per cent. for the same

1. 1923 Convention of Illuminating Engineering Society.

2. Trans. of the Illuminating Engineering Society Vol. XIII, 1918 p. 417.

3. Artificial Light—Its Influence on Civilization, M. Luckiesh, The Century Company, 1921.

4. Journal of the Franklin Institute, Vol. 192, 1921, p. 757.

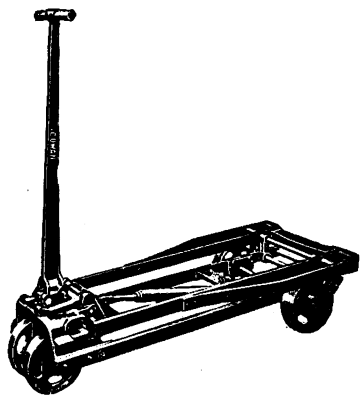
Stop up the profit-draining hole of manual load handling

FOR example, it made it possible for one concern to effect a 43% reduction in handling costs.

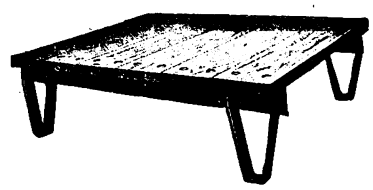
Many executives have unexpectedly found a surprising number of these "holes," through a casual stroll through the shop or warehouse.

Here, two or three men loading a factory truck—when one, with the proper equipment, could do the work. There, five, six, or more rehandlings of materials on their way through progressive manufacturing operations and storage—though all could be easily eliminated.

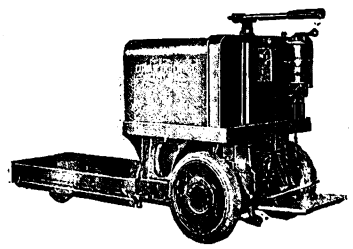
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increase in illumination intensity. This increase in "speed" translated into terms of operation and production adds more evidence.

Let us return again to the matter of quality or color-value of light. There is no question that daylight is the best quality of light for accurate color-discrimination. The evidence is found on every hand. However, daylight is variable in quality as it is in quantity. North skylight has been accepted as the best daylight for color-work but not because it is inherently best but because it is the most uniform skylight both as to quality and quantity. There is no desirable daylight quality that can not be provided by artificial means. Artificial north-skylight and artificial sunlight are available in the form of colored glass filters for use with Mazda lamps. There is also the so-called Mazda "daylight" lamp which provides an approximate average daylight satisfactory for most work.

A recent investigation indicates still further the desirability of light approaching daylight in quality. The test involved reading black print on white paper and color discrimination obviously was not involved. The printed page was illuminated alternately by light from regular Mazda lamps (with clear bulbs) and from so-called Mazda daylight lamps of equal wattage. Notwithstanding the fact that the intensity of illumination on the reading matter was only 2/3 as great with the Mazda daylight lamps as with the regular lamps the majority of thirty-five readers favored the light of the former which approaches daylight in qualtity.[5] The range of intensities was from less than a foot-candle to nearly 30 foot-candles.

Thus we see a constantly increasing amount of evidence favoring higher intensities of a light approximating daylight in quality. Artificial lighting has been developed to a high state of control. Quantity, direction, diffusion, and quality are under almost complete control. Doubtless, many buildings of the future will depend solely upon artificial light just as some of them depend even now upon artificial light. However, natural daylight will always play an important part in the industries excepting in very congested districts.

Much good work has been done in the development of daylighting but let us look for a moment at the neglect of these installations. On every hand in the industries we see expensive daylighting equipment depreciating through lack of maintenance and cleaning. The cost of daylight in our factories and other interiors is comparable with that of good artificial lighting. In many cases the cost of daylight is even much greater than that of artificial lighting, for we must charge interest on the extra cost of glass areas over that of the walls or roof; maintenance; heat losses; cleaning; etc. But having this investment (and in many cases we will always have daylighting equipment if for no other than the psychological reason) it should be maintained in order

(*Continued on page 84*)

5. Light, November 1923.

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The Unaflow Compressor

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(Reg. U. S. Pat. Off.)

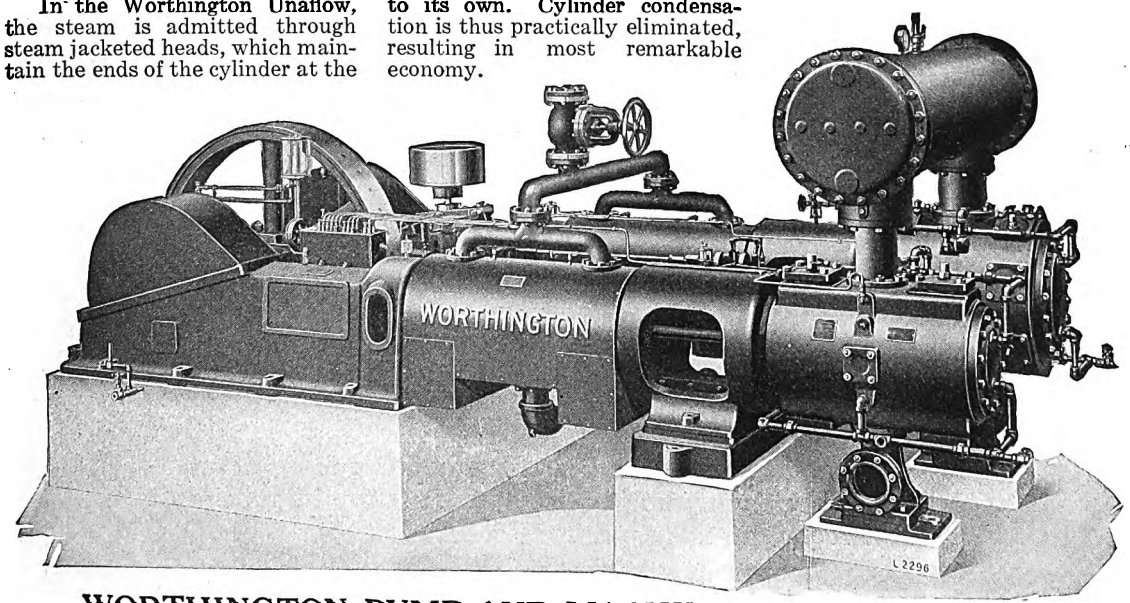
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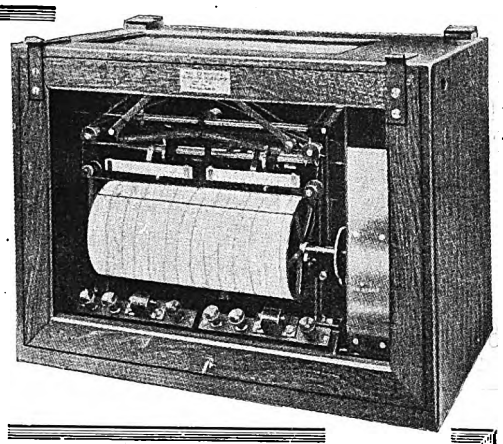
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Blake & Knowles Works *East Cambridge, Mass.*
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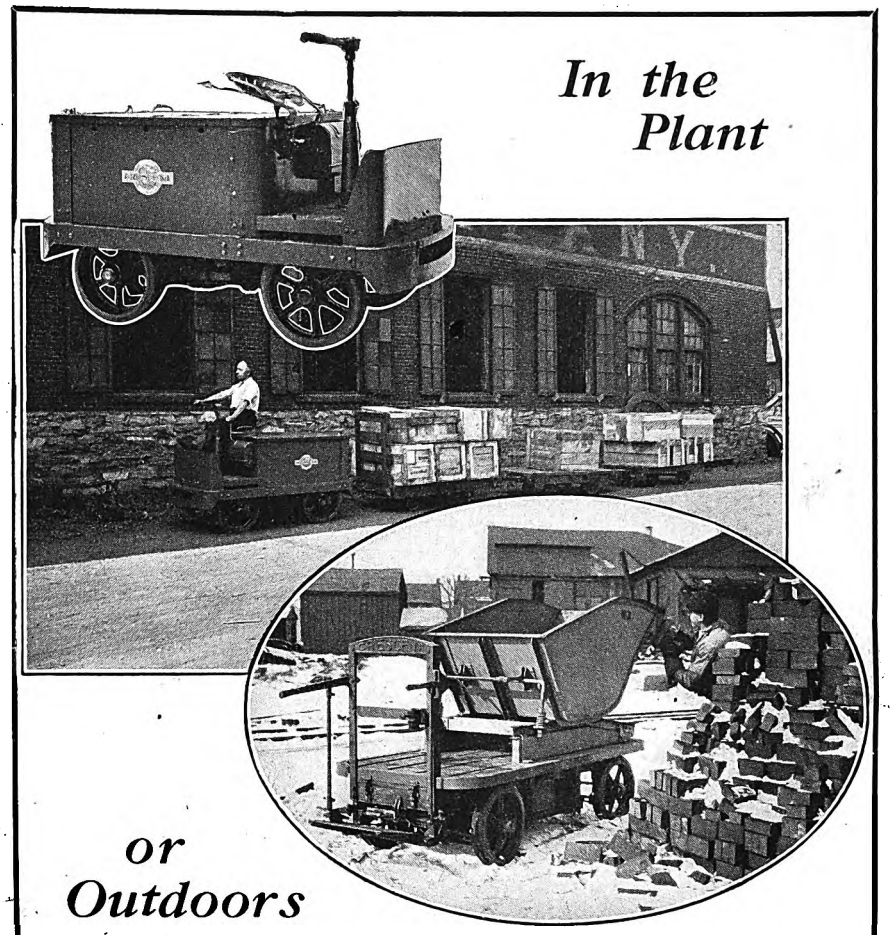
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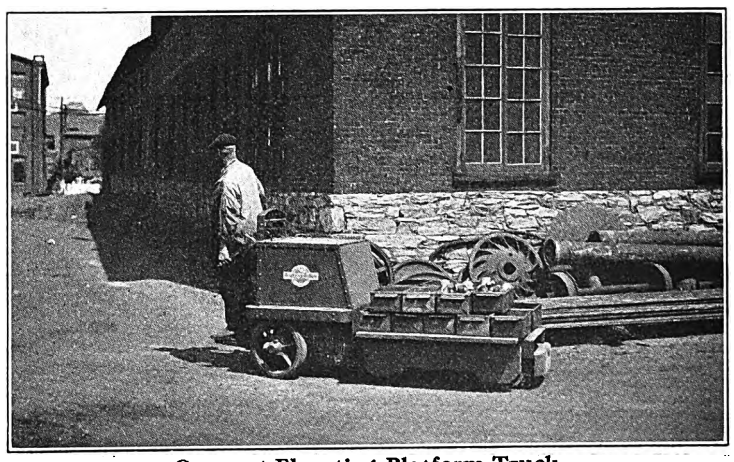
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(*Continued from page* 82)

to realize the best production, the greatest safety, and the least spoilage. However, let us look at the following measurements of the transmission of light by glasses taken at random from the daylighting equipment of various factories; the measurements being made by scientific apparatus.

Transmission of Light

Specimen	Before Cleaning	After Cleaning	Increase
1 Clear	12%	88%	7.3 times
2 Clear	16%	88%	5.5 "
3 Ribbed	14%	80%	5.7 "
4 Ribbed	17%	76%	4.5 "
5 Ribbed	0.3%	75%	250.0 "
6 Wavy	13%	80%	6.1 "
8 Wavy	5%	75%	15.1 "

It is seen from these measurements that, if the daylight illumination intensity in these factories depended solely on the transmission of light through these glasses, the intensity of useful light would increase from 4.5 to 250 times, after a thorough cleaning. These are not unusual cases, because glasses in the industries are subject to severe conditions. Dust, carbon scale, and even acid fumes are common and the glasses are bound to become opaque if uncared for. It is not the easiest matter to clean dirty glasses but fortunately harmless cleaning compounds are available which do the job at a reasonable cost. Just as progressive manufacturers are finding that adequate and proper artificial light increases production and reduces hazards, so are many of them finding that it pays very well to clean the daylighting equipment.

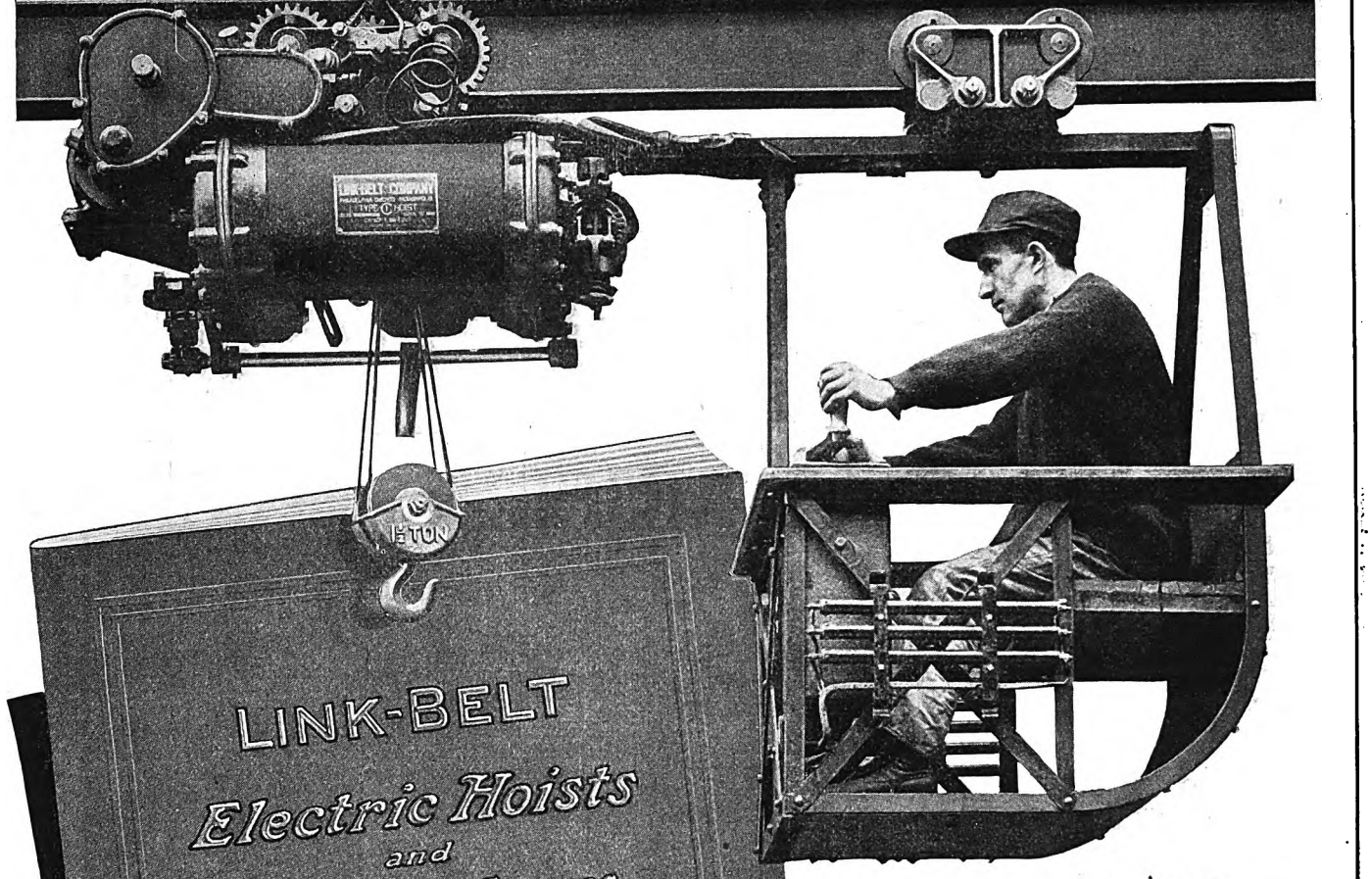
As an example of the efficacy of cleaning glass areas in factories let us quote from an official survey made in a portion of one of the plants of Joseph T. Ryerson and Son, Inc.

"The use of ..... in cleaning 16,000 sq. ft. of skylight in our Jersey City warehouse saves $7,153.60 a year due to increased production and decreased illumination cost. The improved light also reduces accidents fully 10% and eliminates about 5% of the errors in filling orders.

"With better light the whole spirit and atmosphere of our plant changed. The workmen found the conditions far more pleasant and became better satisfied with their jobs. Eye-strain was greatly reduced. On the whole the effect on the workmen was most gratifying.

"As a result of the improved light our men accomplished more work, in fact we attribute a 5% increase in production to this source. Since there are 100 men, this is equivalent to saving the wages of 5 men, or $7,500.00 a year.

"There are other equally important advantages which are hard to express in dollars. For example: Among the men doing angle piling, cuts, abrasions, and other minor accidents were quite common. On other kinds of work major accidents are bound to occur in spite of all precautions. The increased light in our plant has easily reduced accidents by 10%, with a consequent saving in



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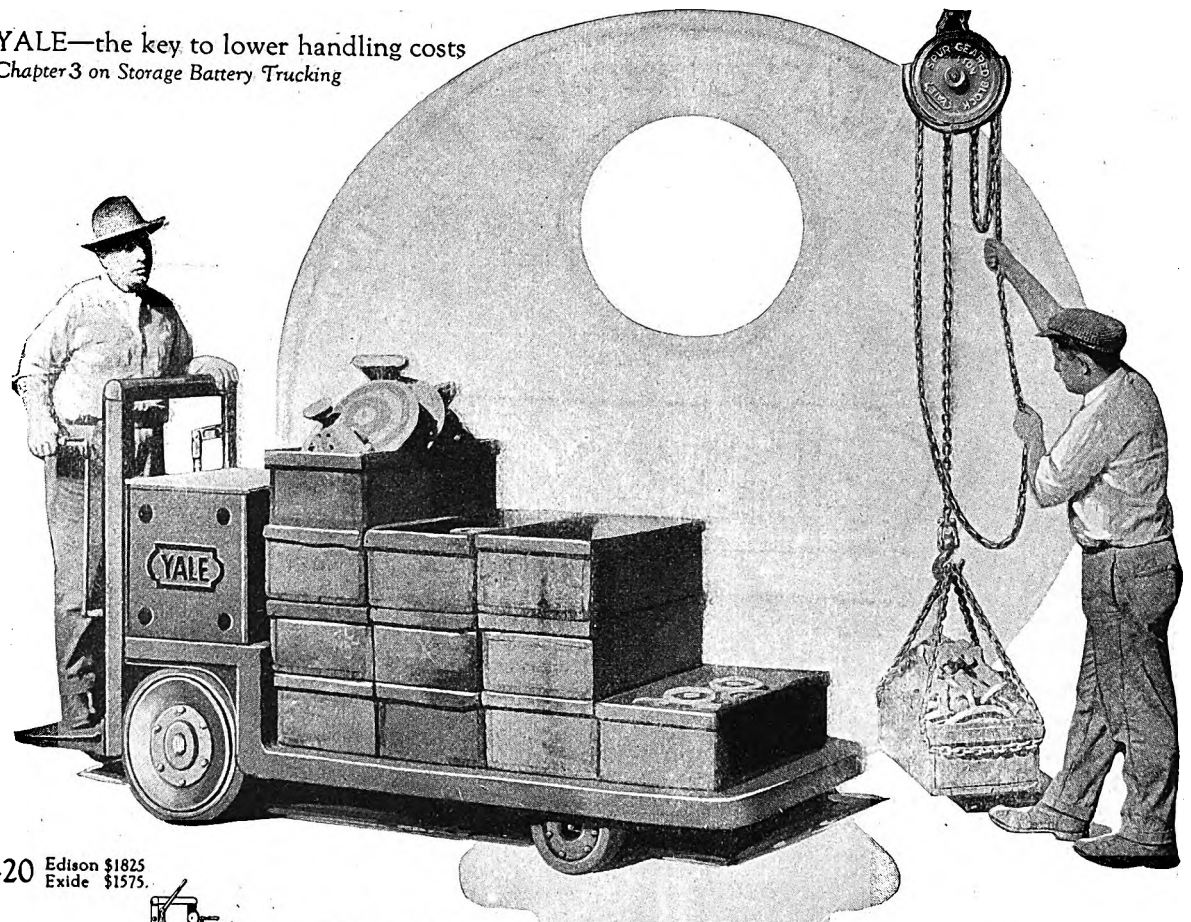
"We feel certain that the umber of errors in filling rders has been reduced at east 5% by the improved ight. This results in greater ustomer satisfaction—a nost important asset. It lso saves the cost of hand-ing claims and trucking or-ders incorrectly filled.

"Labor turnover is affect-d by so many factors that t would be difficult to prove he effect of better light on his important cost. How-ver, there is no doubt that our men appreciate the more leasant working conditions, and that this will affect abor turnover favorably."

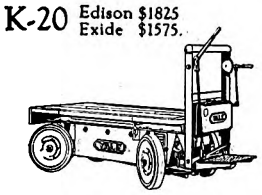
The report contains many er details and ends with a tement that the net saving epays the cost of the clean-compound more than twen-eight times."

n closing, let us repeat that ht is essential to human ac-ities. As we progress into s present scientific age we finding that not only light adequate and proper light-are also essential if we are keep the pace with the com-tition of neighbors and of tions. The best lighted in-stry, other things being ial, is the most prosperous lustry. The best lighted ntry—the United States—the most progressive coun-. The lighting of this ntry has not reached a high ndard by any means. It ds other countries because lighting of other countries so poor. However, lighting rapidly developing and its nefits are being proved every y. If we are to enjoy the uries of the present age we nst harness everything that reases production. If we e all to enjoy automobiles, dio, our own homes, etc., we st increase the production our present factories even further. When we have done the best possible with daylight and artificial light the latter must be depended upon for an extra shift. Possibly we must go eventually to the two-shift day in order to get even more production from the same overhead. But leaving out production, we are finding on every hand that good lighting, whether natural or artificial, makes the worker happier and arouses pride of workmanship and of personal appearance. It is in darkness or gloom that discontent, viciousness and crime flourish best. We owe it to ourselves to harness light to increase the safety, the efficiency, the productiveness, and the happiness of mankind. This is best done by taking from Nature that which is good for us and improving upon it to suit best our needs that we ourselves are responsible for because we have built this artificial world that we call Progress.

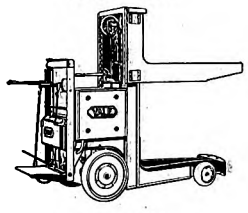
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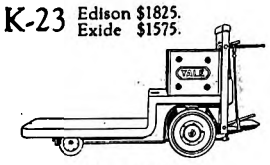
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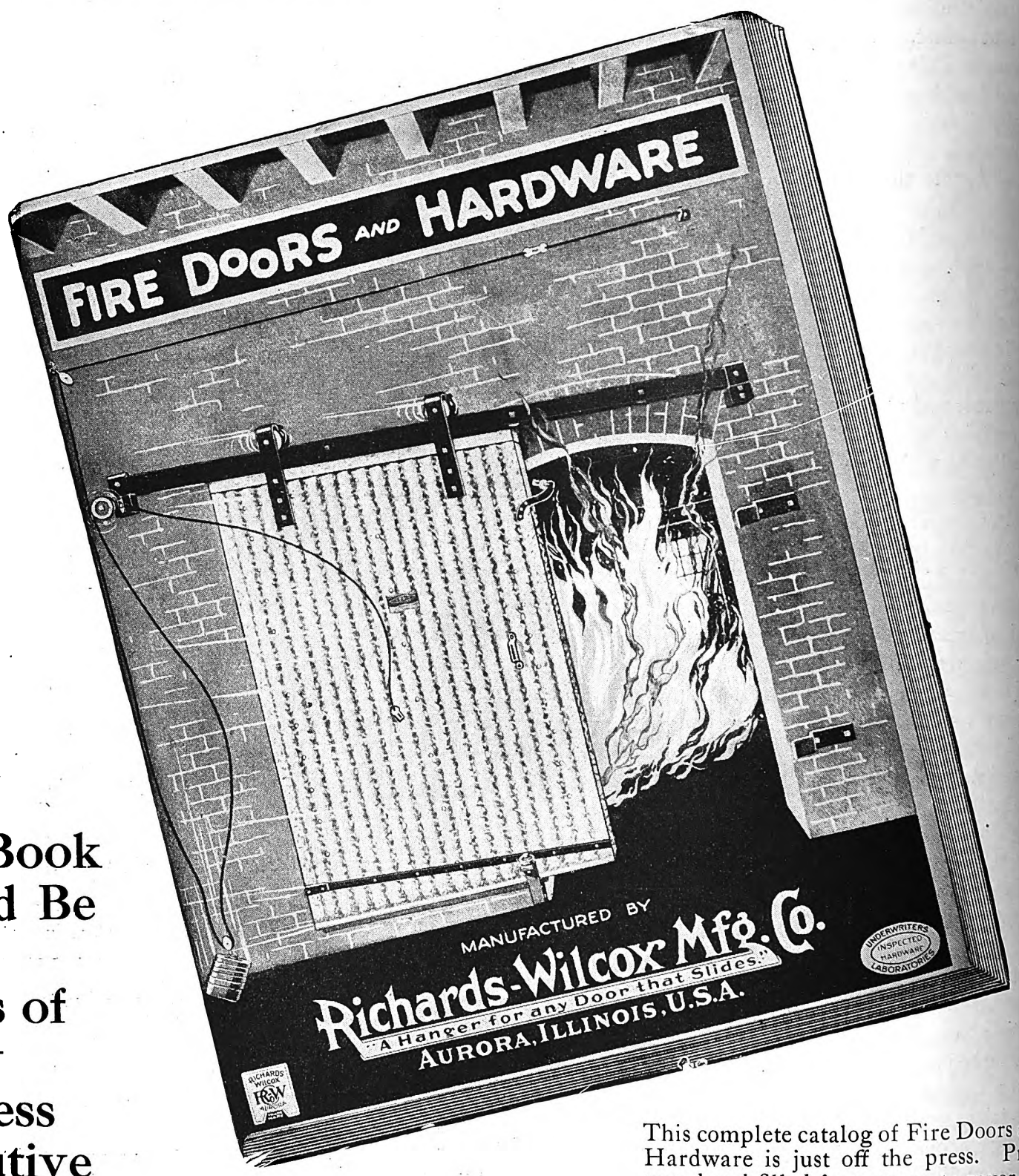
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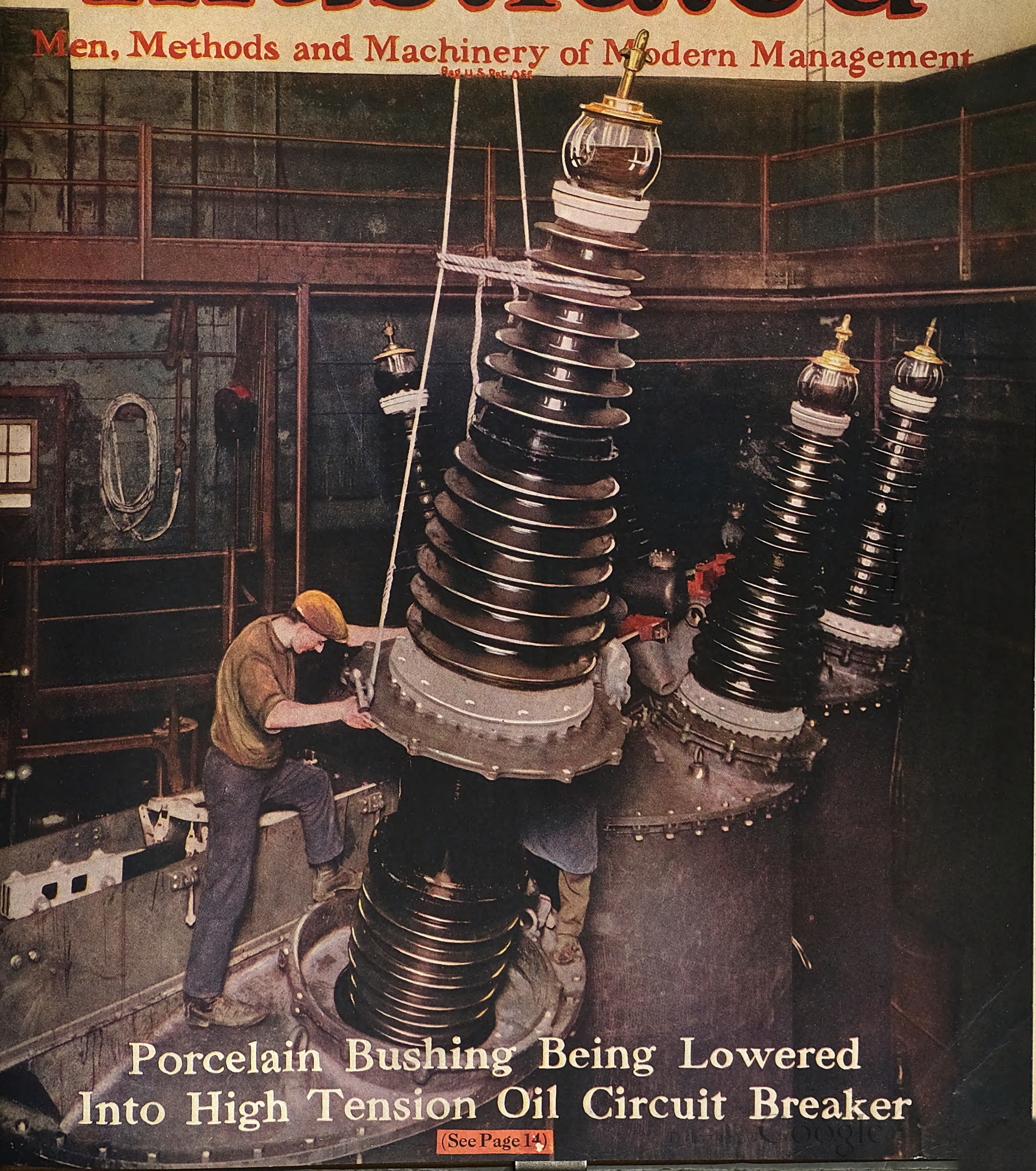
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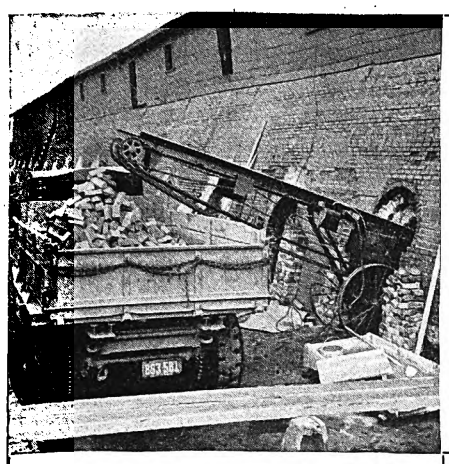
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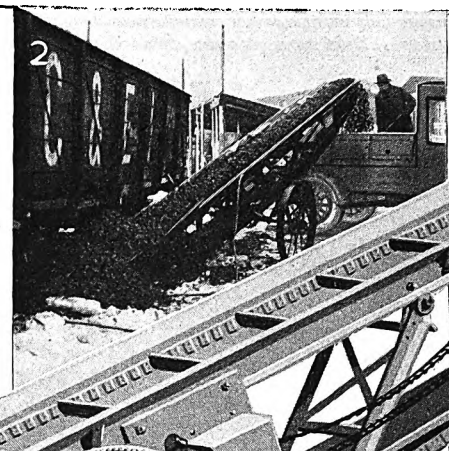
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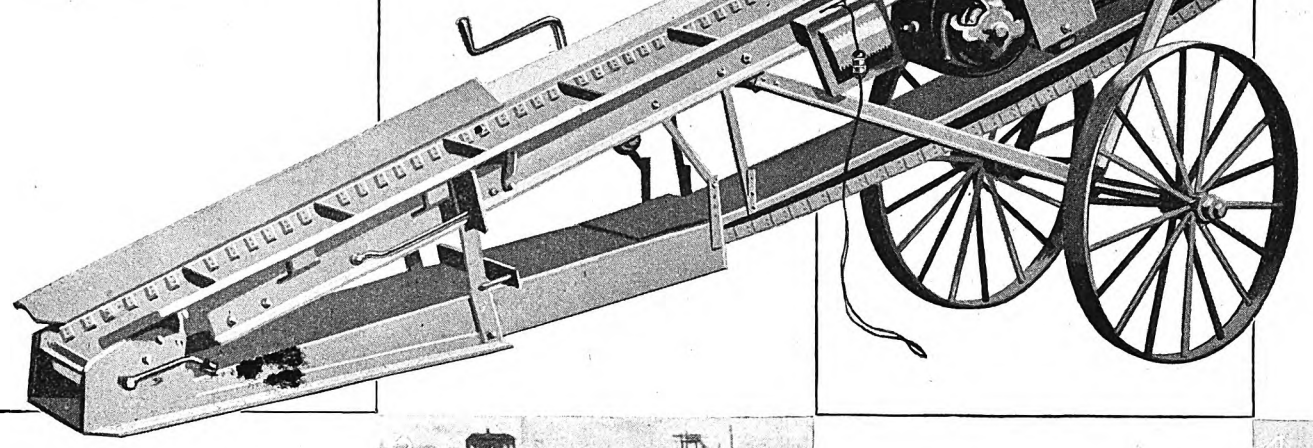
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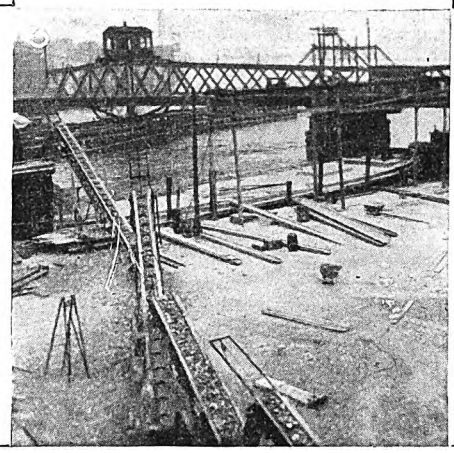
1—*REPLACING WHEELBARROWS, A Type U Loading brick from a kiln for the Onondaga Brick and Tile Co. at Onondaga, New York. It shortens wheelbarrow hauls in this case. In others, it does away entirely with wheelbarrow work.*



2—*UNLOADING CARS. A Barber-Greene Type U being used for "hauling out" coal by the Martin Lumber Company, Geneva, Illinois.*



U-Type-Barber-Greene Portable Conveyor, equipped with electric motor.



3—*LOADING FROM PILES. In this case, the material handled is oyster shell, and four Type U Barber-Greenes carry it from stock piles to barges. New Haven, Conn.*

4—*PIT WORK. A Type U handling gravel for Pierce and Piron, of Aurora, Ill.*



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What Is Ahead of Industry in 1924?

An Editorial Review and Forecast

WHAT is ahead of industry during the coming year?

Will 1924 be a year of industrial prosperity, with growth and advancement for the firms and individuals which shape their courses to the rising tide?

Or will it be an "off" year, the ebb tide of which will call into play the most skillful piloting and an unabating struggle to maintain positions and profits against its adverse current?

Some six months ago many of our professional prognosticators stated that we were inevitably headed for an immediate and serious period of depression. Since that time, and in spite of the damage necessarily done by the utterance of these predictions, business and industrial activity have continued their unabated way until today we are in a position second only to the boom peak of 1920. In car loadings, commodity prices, employment, wages and financial ability to pay its way, this country is in a sounder position today than it was when these pessimistic prophecies were broadcasted. Since then, Ford production has been boosted from eight to ten thousand cars per day, the United States Steel Corporation has declared an extra dividend on its common stock and the General Electric Company reports the astonishing and impressive total of fifty per cent. more in unfilled orders on its books than those of the year preceding. These cold, indisputable facts not only are of far more weight than all of the prognostications and curve projections of economic seers, but in addition they eloquently attest the fallibility of such prophecies and the danger of shaping one's course by them.

If the industrial executive is to look ahead intelligently into 1924, he must shape his own conclusions on the evidence of substantial facts instead of ingenious theories, and discard the fluctuations of the stock market as a barometer of industrial prosperity. The purpose of this editorial, therefore, is to lay before industrial executives not a prophecy nor a prediction, but a few plain fundamental facts from which it may help the responsible man to make his own predictions and his own plans for his own business.

* * *

As industry and business have progressed, as they have grown in volume and in specialization, their components have become simplified, but their entirety more complex. This is a truth that should be grasped by all who plan either the progress of individual industrial plants, or individual industrial careers. For it has a direct and heavy bearing upon the future.

Factors that were unthought of twenty years ago are daily growing in importance, becoming more simple in their elements and more complex in their entirety. Twenty years ago it apparently mattered little what sort of a building was available so long as it had sufficient space in it to contain the necessary machines. The manner of placing these machines, or their arrangement, was of secondary importance. It mattered little what sort of a roof covered the plant if it kept out most of the rain. Holes, broken in window panes, let in more light than the grime-incrusted glass, and furnished usually the sole means of ventilation. In winter, men left their machines at frequent intervals to warm numb hands at the "salamanders" or indoor bonfires. A floor was a floor whether of dirt or rough wood plank, attracting and receiving no attention so long as brute strength was capable of hauling, pushing, or prying loads over its uneven surface.

In the old days dirty, cluttered buildings were the rule, and clean, orderly buildings the exception. Broken windows were replaced once a year, in the Fall, at the time of the annual window cleaning. Paint was used generously upon the product, but sparingly upon the plant. Fire protection consisted in a possible insurance policy plus occasional half-filled water buckets. Friction loads of misaligned transmission shafting in many plants equalled or exceeded the power used in driving the producing machines. Millwrighting was an all-embracing title including the duties of power plant engineer, machine repair man, foundation builder, sewer excavator and construction boss. Today a dirty factory is a disgrace, the cluttered floor a sign of inefficiency, grimy windows and unpainted walls a sure indication of poor management. Keeping the plant fit for profits, from the standpoint of intelligent maintenance, requires its regular "daily dozen," its specific organization, and is as essential in the minds of modern, progressive executives as is keeping the body fit physically.

These conditions have led inexorably to a progressive and continuously increasing economic pressure for *more work per man.* This demand, which has led, in America, to the creation and improvement of vast quantities of automatic and labor-saving machinery, has been tremendously stimulated since the restriction of immigration. Demand, per capita, is increasing faster than the infiltration of new labor. All industries are beginning to feel the urge of this condition. The most successful industries will be those who best, and most quickly, respond to it. It is a condition that is here to stay for many years. It is the condition which will cause management its most acute difficulties and problems in 1924. It is the condition which will force inventive ingenuity to its limit, cause industrial executives to go over their manufacturing methods with a fine tooth comb, and thus prepare themselves for the most severe competition that they have yet had to face—not a competition in quantity production alone, not a competition in price alone, not a competition in sales methods alone, but a competition in searching out and installing the methods and machines that will result in more output per man, be he laborer, salesman, skilled mechanic, superintendent or chief executive. This, as we see it, is the foremost problem for 1924. No matter how good a year it may be for business in general, it will be a bad year for those who fail to follow this course of evolution. No matter how poor a business year it may be, it will be a good year for those in

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the vanguard of more output per man, and the real progress of these leaders must come from the close study and clear understanding of factors whose influence on costs and profits has hitherto been overlooked.

Merely following the time-worn road of the improvement of producing machines will not lead to this desired end. For the past two decades the active minds of American inventors have been centered upon the improvement and speeding-up of the individual machine, of replacing hand work by automaticity. Intensive concentration of so many minds upon a single subject has developed this phase of production to a point of impending saturation. Exceptions naturally will occur to this rule, but the big improvements in manufacturing economy in 1924 will lie outside of the improvement or speeding up of the producing machines. They will lie in directions hitherto thoroughly unexplored but which are destined in time to become main highways of efficiency.

* * *

For the past year our more progressive managers have been giving more and more attention to the matter of transportation. They have begun to discard the older idea of the primacy of the individual machine. They are centering their attention today upon the process, and not the individual operations, which have been perfected to a point beyond which refinements do not return proportionate dividends. They are finding a fertile field for improvement in the coördination of these operations with respect to the process and with respect to the flow of production. They are finding it necessary to make a careful study of mechanical handling—and that such studies pay big dividends! So important have we considered this new phase of management that during the past year we have published what is undoubtedly the most complete and extensive coverage of the subject of mechanical handling ever yet attempted. We shall continue to extend and improve this series during the coming year, and mention these facts at this time for the purpose of impressing upon our executive readers the importance that we attribute to this subject from the standpoint of managerial responsibility.

That there is a close relationship between the building and the production secured therefrom has been accepted for some time. How great this influence may be is just beginning to be realized. The remarkable development in transportation and mechanical handling has had substantial effect in bringing this about. It is beginning to be realized that productive machines, transportation machinery, buildings, and the human organization as well, are but parts in one big machine. These parts, to function at their maximum, must be properly adjusted to one another. A building can materially aid or materially hinder production. It can help to cut costs or to raise them. Its activities in either direction are long-lived, for a building is much more permanent in its nature than the equipment which it houses. Many of the factory buildings that we see today are actually hindering production and boosting costs—have been doing so ever since they were built—furnishing a permanent handicap to the manager in his struggle for a commensurate profit. Here is a subject about which surprisingly little has been written. It is a subject that executives must begin to study because, more and more, the handicap or the aid of the building will serve to tip the scales toward loss or profit.

* * *

As an aid to executives in their study of these problems, we are commencing in the January issue a series of articles on this important subject. This series will cover every phase of new construction and extensions and fixed equipment, and will show how the plans, the fixed equipment, the materials selected for the building and its construction directly affect profits.

While the profit-making or profit-losing possibilities begin with the planning and construction of an industrial building, they do not end there. Managers today are finding that properly conducted maintenance—keeping the plant fit for profits—frequently represents the difference between no dividends and full dividends on the capital stock. And it is much easier today in most plants to save, and thus make, a dollar through proper maintenance than it is to save and make an extra dollar through production. Mr. Ziegler, who is writing the series on Modern Maintenance of Plant and Equipment, now running in this magazine, brings out this point clearly, and also shows definite practical ways in which to corral the dollars that are now escaping through sheer neglect of maintenance.

* * *

There are certain outstanding manufacturing plants familiarity with which provides a liberal education in industrial methods. Of course it is impossible for a busy executive to take the months of time that would be required to first familiarize himself with the physical environment of such great plants and next analyze and absorb the lessons which their policies and their practice involve. It is with the purpose, therefore, of putting such visits within the reach of every executive that we are describing in 1924 the production problems of the General Electric Company. This is a logical sequence to the complete description of Ford Principles and Practice at River Rouge, which we have published in serial form during the past year. We believe that executives who follow this new series of industrial "travelogues," and who review the preceding one, will be materially helped in their own problems of 1924.

* * *

Nineteen twenty-four is before us. One year from now it will be a record of our own accomplishments and shortcomings, of our industrial successes or failures. No man can tell you what sort of a year it will be for you, for it will be the kind of a year that *you* make it. It is being ushered in under favorable conditions and circumstances. Earning and buying power is high, labor discontent is diminishing, American finances are in strong position and industry is getting away, for the race of 1924, with as good a start, if not better, than for any preceding twelvemonth. But the race will be a gruelling one. Competition will be strong and your own competitors will strive to make it stronger. A good track makes fast going for all horses. You will need to make every step count.

Your gross sales in 1924 may not be as large as they were in 1923. Yet your profits, in spite of this, may be larger. They *will* be larger, even on a diminished output, if you will extract from your operating costs the necessary dividend charges. And you can do this—not by speeding men or machines to the breaking point, not by cheapening the quality of your product, but by organizing to survey the yet unbeaten paths of maintenance, mechanical handling and better buildings.

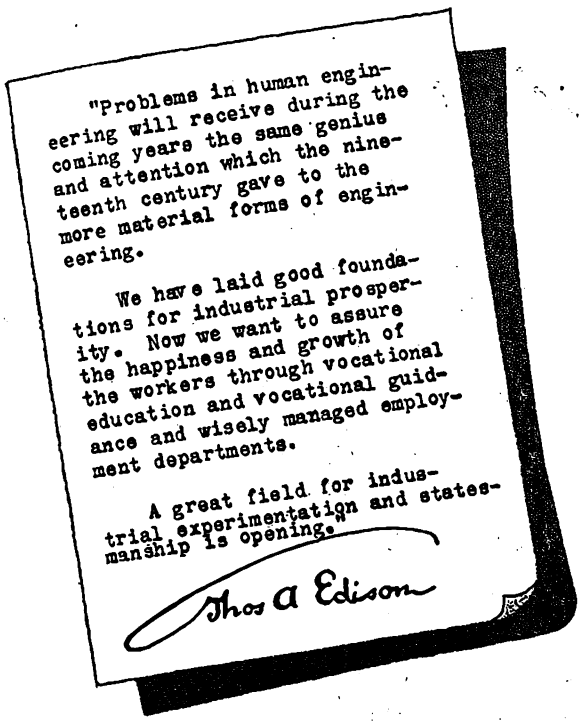
Finally, bear in mind these fundamental and obvious facts: The United States is the richest, the most powerful, and the foremost country in the world today. We are the center of World credit. We have the Gold Standard of values firmly established, and in the Federal Reserve Banking Act we have the most perfect banking system that has ever yet been devised by the genius of man.

Wages for all classes of skilled and unskilled labor have never before been so high in peace times—and they are certain to remain high, because of the restriction of immigration. This means an unprecedented buying power, and this immense volume of buying power, of one hundred and ten millions of enlightened, ambitious and prosperous Americans, is certain to keep all our legitimate manufacturing enterprises busy—if they be rightly managed!

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Is Industry a "Cold, Relentless" Machine?

A Prophecy —and Its Fulfillment



"Problems in human engineering will receive during the coming years the same genius and attention which the nineteenth century gave to the more material forms of engineering.

We have laid good foundations for industrial prosperity. Now we want to assure the happiness and growth of the workers through vocational education and vocational guidance and wisely managed employment departments.

A great field for industrial experimentation and statesmanship is opening.

Thos A Edison

The fac-simile reproduction of Mr. Edison's prophecy, at the left, appeared upon the cover of *Industrial Management* for January, 1917 — almost exactly seven years ago.

DOCTORS tell us that the development of the human body progresses apparently in seven-year periods. It would be stretching the point to attempt to draw a parallel between the development of the human physical structure and the development of that complex, man-made structure called industry. Nevertheless, the thought is called to mind by the recent statement of Mr. Charles M. Schwab, at a dinner given in his honor by the Engineers' Club at Philadelphia.

In January, 1917, INDUSTRIAL MANAGEMENT had the privilege of publishing a prophecy by Thomas A. Edison. So important was this prophecy considered, that, as evidence of hearty concurrence in the belief expressed, it was reproduced in fac-simile on the cover of that issue. That this belief was accurate is illustrated in a striking manner by the recent address of Mr. Schwab, from which we take the liberty of quoting as follows:

"In recent years," he said, "the engineers of America have directed their energies not alone toward great mechanical achievements, but toward the promotion of sound and amicable relations with labor.

"The people who labor are not and cannot be treated like dumb, driven cattle. They are above all else human beings, with feelings and sentiment, hopes and aspirations, and the fundamental problem of all industry is to so relate the human elements in the men who do the work, to the machines which they operate, that the men themselves shall first of all be happy and healthy, and that they shall thus be able to operate their machines with good spirit and efficiency.

"Few things in our American life are more wonderful than the great enterprise Henry Ford has developed. Mr. Ford has taught us all many new lessons in the handling of machinery and large scale production. But all of Mr. Ford's machinery and plans would have amounted to little had he not been able to build upon the foundation of satisfied and happy employees.

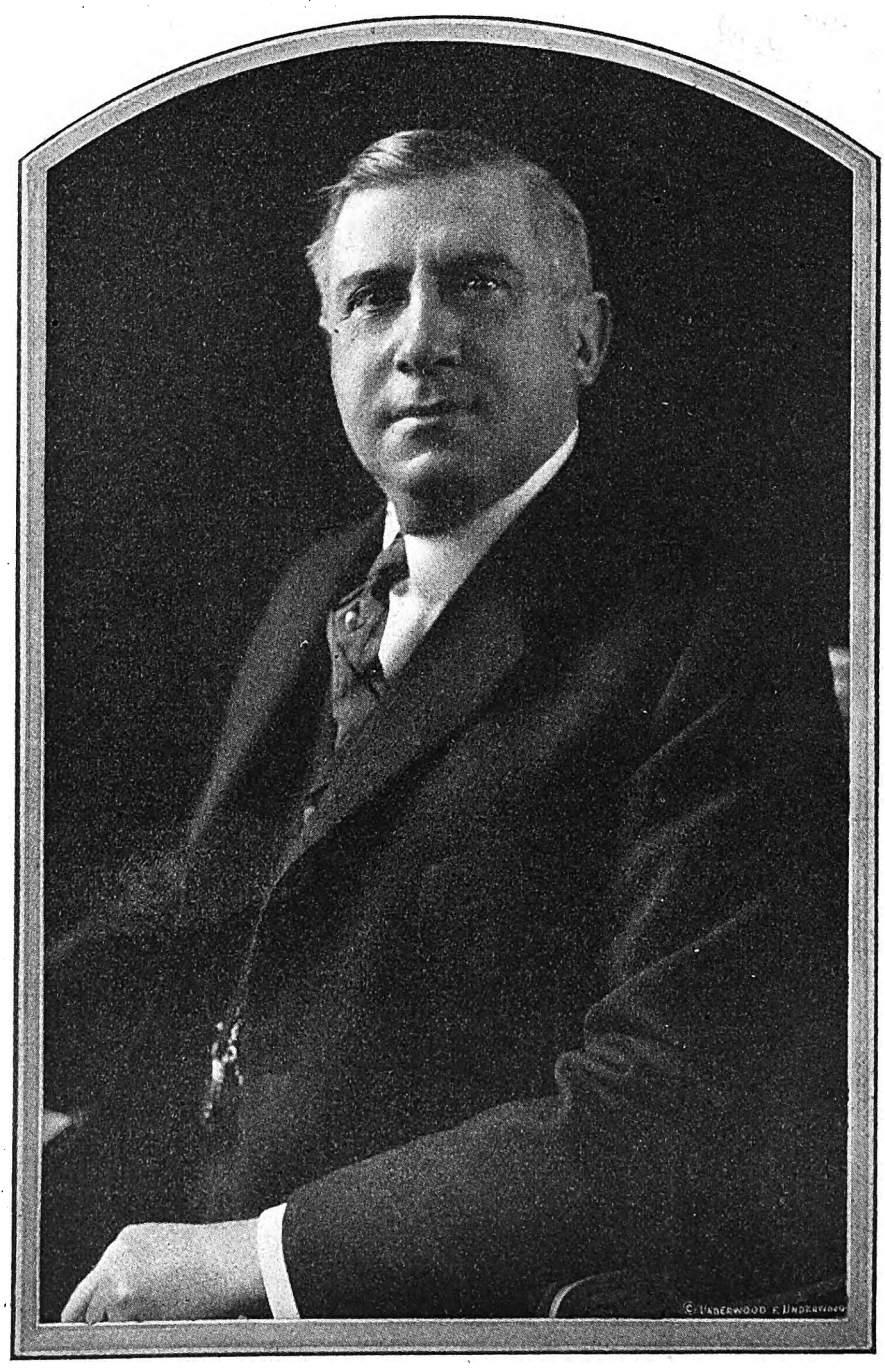
"When during the war I was placed at the head of the Emergency Fleet Corporation I realized that the need was not so much for machinery or more machinery, but it was to put spirit and power into the hearts, minds and muscles of the rank and file of the men who were doing the work. To build great plants, to erect huge machines, would take time, and the war would not wait. Yet to put new life and spirit into the men who were doing the job could be accomplished in a very short time.

"Hence I paid but little attention to the mechanical and material end of the business. I devoted my time to going among the men, both the superintendents and the rank and file, and seeking to promote in them a spirit which would enable them to get miraculous results with the material at their command.

"Many people conceive the relationship between capital and labor as one of stress and struggle. They talk as though the interests of the two were different. My experience is that there can be no success in industry unless there is at least a measurable appreciation of what is so fundamentally true, namely, that the interests of labor and capital are identical.

"Perhaps the division of the effort of industry as between labor and capital is not always equitable, but the effort of all engaged in industry should be to make that division even more equitable. And that is the direction which human engineering is taking today, an effort in

(*Continued on page 77*)



Charles M. Schwab, whose acknowledged position of leadership in present-day industry lends significance to his views, as expressed in a recent speech before the Engineers' Club in Philadelphia.

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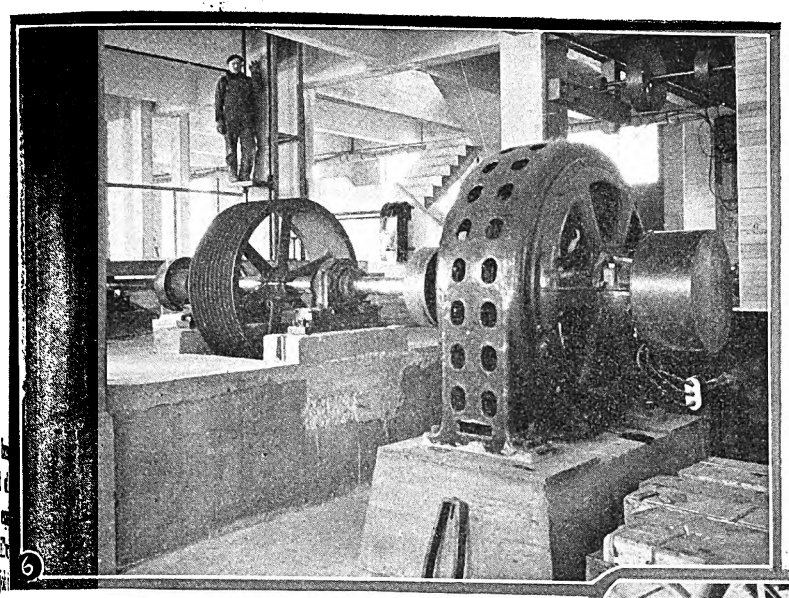


Fig. 6. Friction losses are minimized in this installation by means of six-inch self-aligning ball bearing pillow blocks.

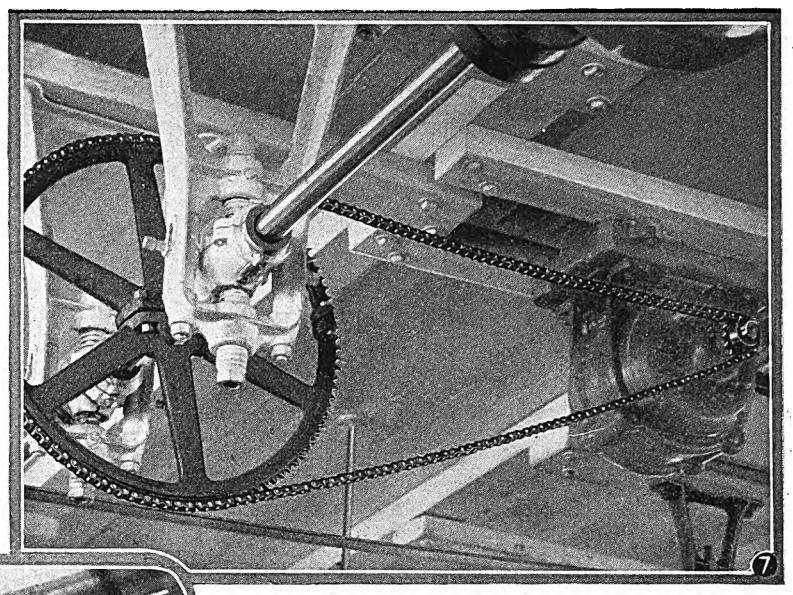


Fig. 7. Chain drives insure a positive action without slippage and require proper care and lubrication.

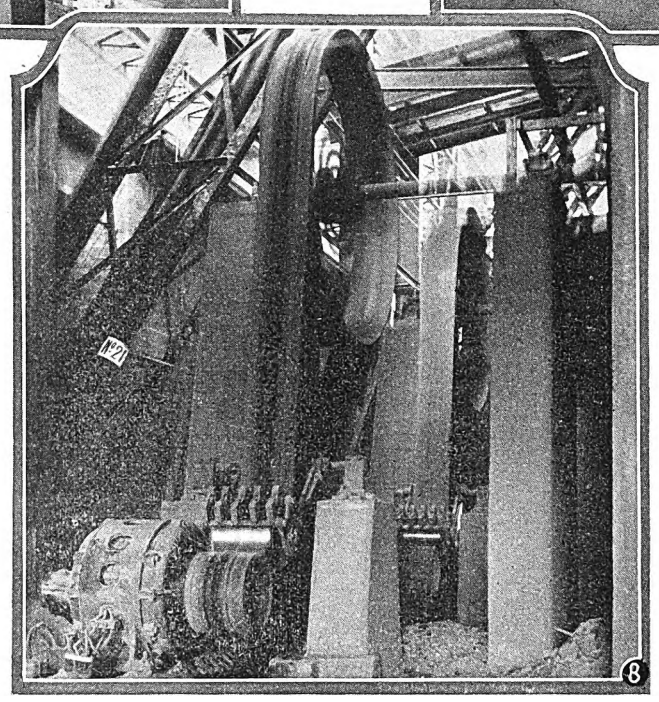


Fig. 8. Short belt centers and high drive ratios do not necessarily mean inefficiency. But they call for special treatment as indicated above.

waiting for something to happen; they can be used on small jobs from which they can be called at any time.

The item of friction losses looms large in the power bill of any plant, and it is therefore important that every effort possible should be made to cut them down. A loss of 20 per cent. of power consumed is not unusual in the average plant where this item has not been looked into.

Friction is a greedy consumer of power, especially if wearing surfaces are not well lubricated. Where plain bearings are used throughout the plant, a high grade lubricating oil should be used in order to cut down as much friction loss as possible in that way. The installation of ball or roller bearings is sometimes advisable. This can be decided on when conditions are known to be bad and a sufficient saving in power can be shown to offset the investment. Good grease is very important on ball and roller bearings to prevent rust and retain lubricating efficiency over a long period.

Another preventable cause of friction is tight belts. They spring the shaft out of line and wear the bearings. All belts should be just tight enough to deliver the power they are designed to deliver. Sometimes the cause of belt slippage is not on account of the tightness of the belt, but is caused by having pulleys too small. Then it is necessary to increase the size of both the driving and driven pulleys to get enough surface for the belt to cling to. Try to equalize the belt pull on both sides of the main line so that bearings won't get worn on one side. This point brings up the arrangement of machines.

In planning the grouping of machines, the aim should be to cut down the number of belts and countershafts required. It is often possible to put in a single jackshaft, driven by one belt from the main line, to drive several machines directly under the jackshaft. It is a cardinal rule that the power be delivered to the lineshaft at the middle of its length, and with motor drives it is usually convenient to do this. When a main lineshaft is driven from one end, that end of the shaft is subjected to much more severe torsional strains than it would be subjected to if it was driven at the middle. It also tends to throw the shaft out of line and this of course causes friction. Correct speeds of belts and machines are another possible way to reduce the loss of power. In order to be sure of speeds being

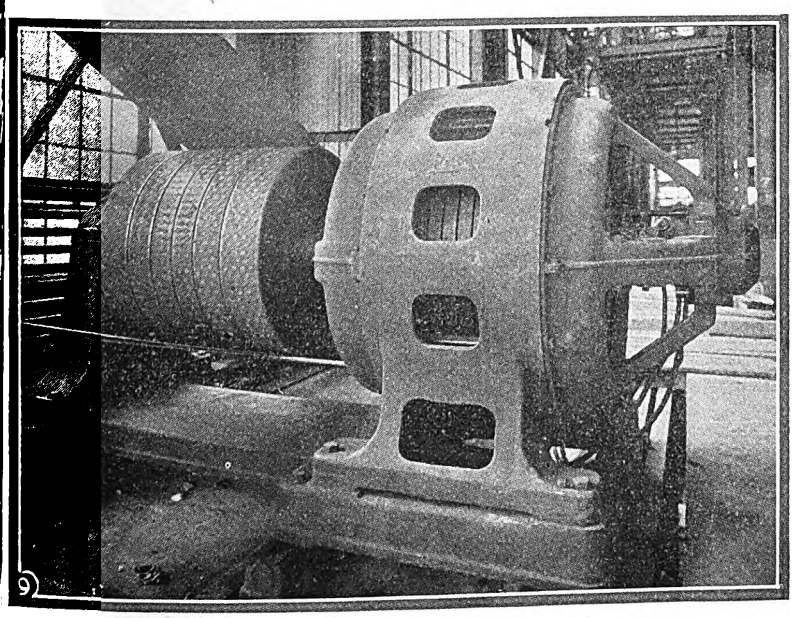


Fig. 9. Friction disc inserts on this driving pulley guard against slippage, loss of power and profits.

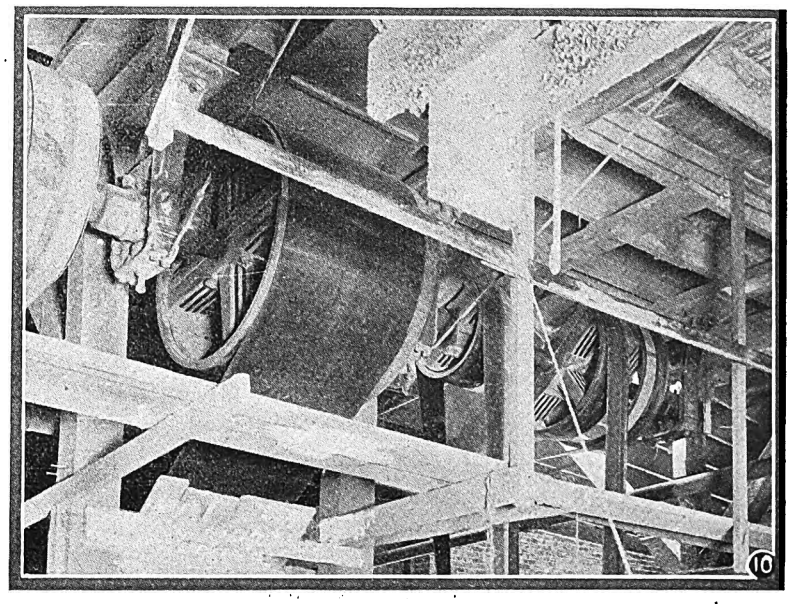


Fig. 10. Wooden pulleys are light, rugged, easily installed and well adapted for their specific purposes.

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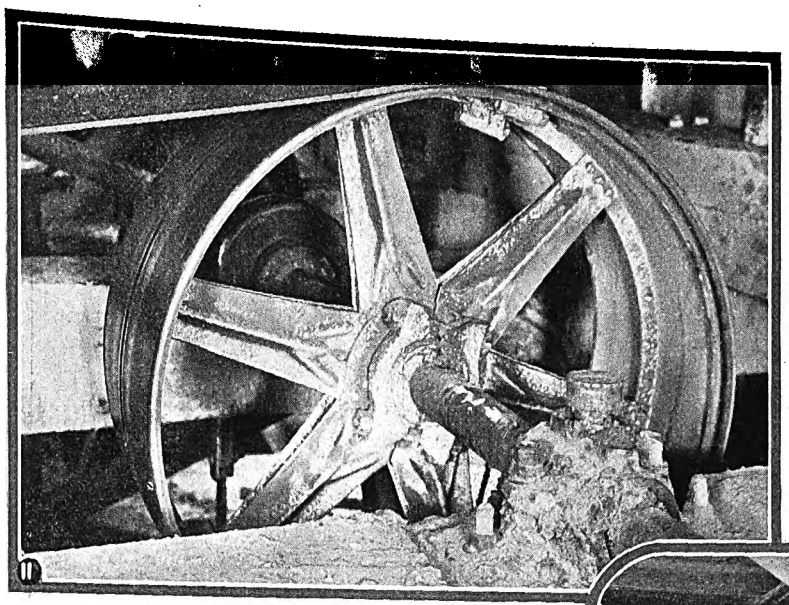


Fig. 11. Pressed steel pulleys are coming more and more into use. This shows a pressed steel split pulley installed under arduous driving conditions.

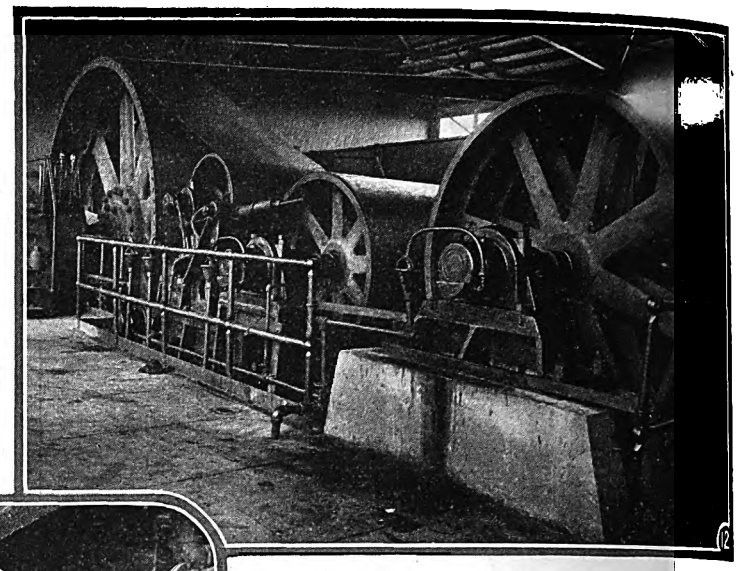


Fig. 12. On this Morgan drive in a steel mill we have an illustration of two belts on the same pulley.

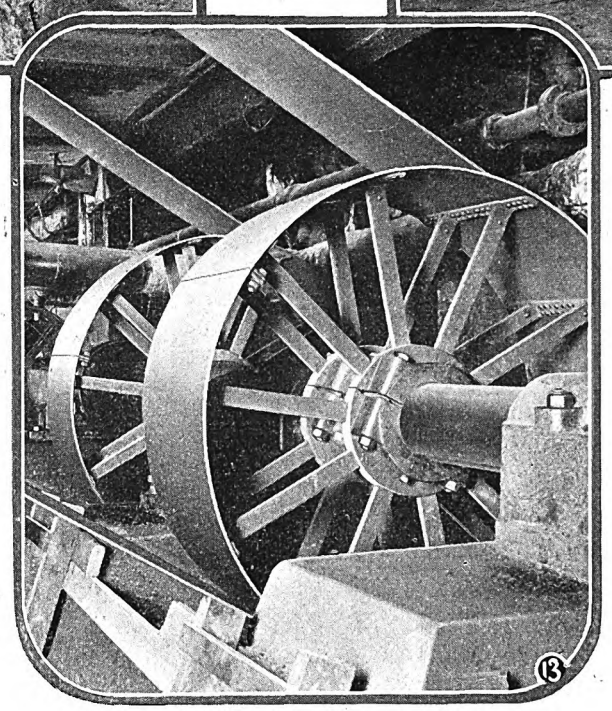
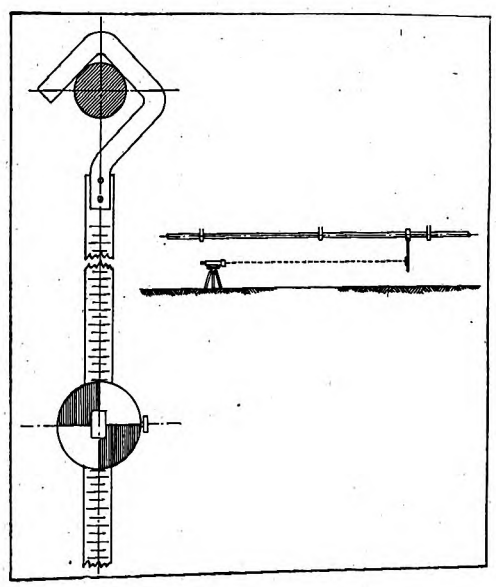


Fig. 13. A case of severe drive service is illustrated here. These pulleys are seven feet in diameter and five feet face, and transmit 850 horsepower at 183 r.p.m. The belts are of stitched rubber.



Where considerable shaft aligning must be done the transit and target method saves time and money. The sketch speaks for itself.

Fig. 14. Each belt (below) is 107 ft. long. Their record of close to two million miles travel — twenty-four-hour service since 1917—speaks well both for the belts and for the men who installed and maintain them.

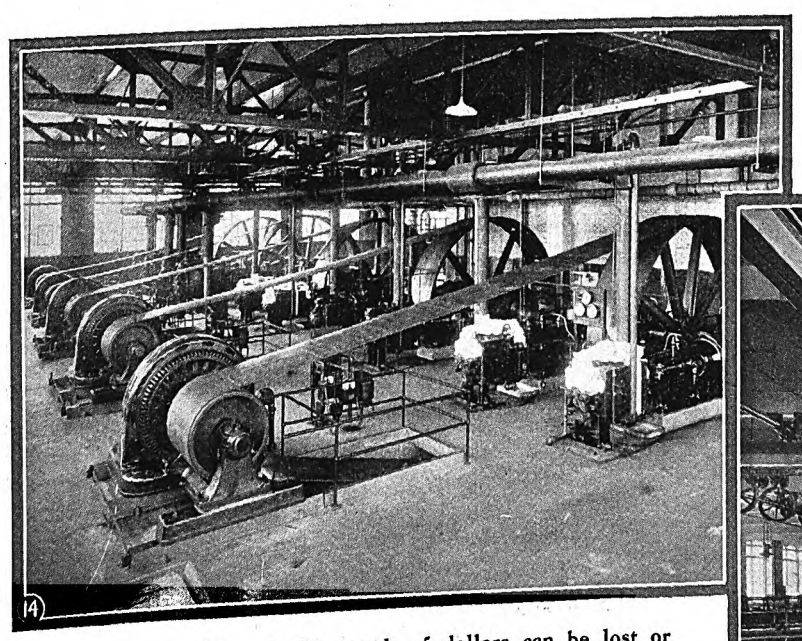
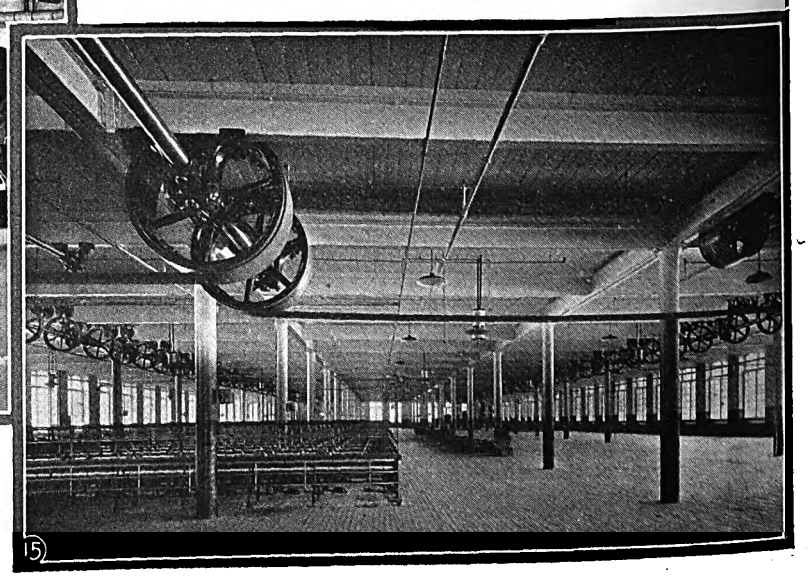


Fig. 15. Thousands of dollars can be lost or saved annually through the poor or good condition of maintenance of overhead transmission equipment.



correct, a good speed indicator, or better yet, a good hand tachometer should be used to check up.

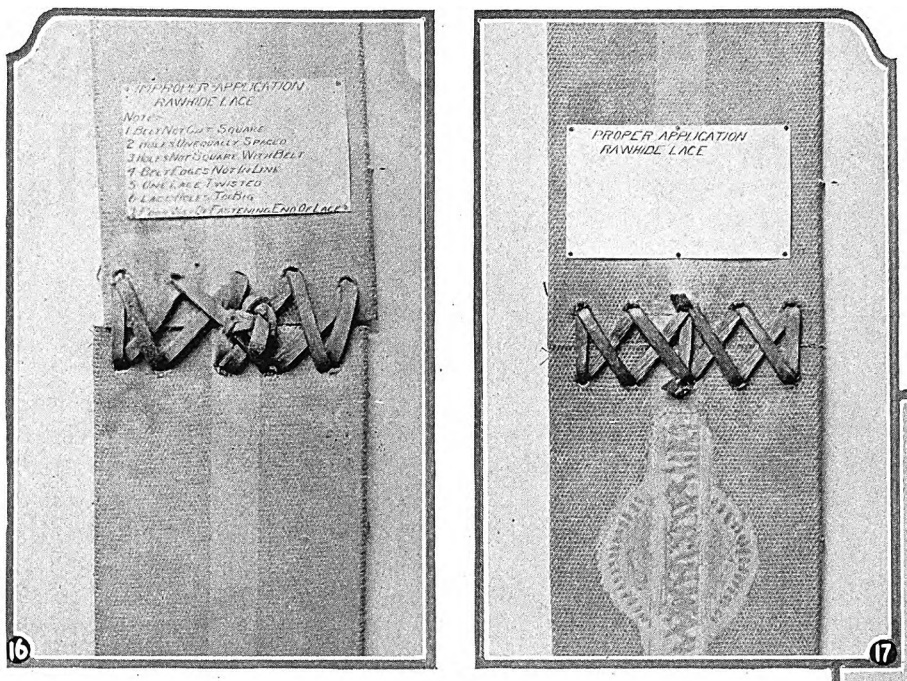
Main lines can be lined up in several different ways. A piano wire held by a clamp about six inches left or right of the shaft is a good method for sidewise lining. Turnbuckles are needed to tighten it good and tight. The wire is apt to sag a little and should not be used for very long shafts for up and down lining. A good method for accurate lining is to use a transit or builder's level and plumbob and leveling rod. The transit should be set up directly beneath one end of the shaft to be lined, and by using a plumbob and a leveling rod held upside down against the bottom of the shaft, it is possible to line up accurately and quickly. If much of this work is to be done, the leveling rod can be provided with a hook so formed as to allow the rod to hang plumb.

In a steel frame building, hangers are sometimes bolted directly to the beams or trusses and it is then advisable to insert lead washers under the feet of

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the hangers so that vibration can't work the bolts loose. As an additional precaution, however, lock washers or lock nuts should be used. These bolts should be tightened up when they are inspected, which should be at least once a year. The boxes in the lineshaft hangers will work loose even though there are locknuts on the adjusting screws, and it is therefore necessary to inspect and tighten these occasionally. If the motor drive is near the center, thrust collars can best be put at the hangers either side of the motor.

In case a whole department is to be moved or entirely rearranged, the subject of the most economical main line speed should be thoroughly investigated. Several items are in favor of high speed main line shafts, viz.: smaller diameter and therefore cheaper shafting and smaller diameter pulleys. To offset these savings, the use of ball or roller bearing hangers, with a rather high first cost, is generally necessary. However, if the savings in friction loss, over a long period of time, are taken into account, it will usually be found that ball or roller bearings will pay for all main lines. Another point in favor of these types of bearings is the reduction in cost of maintenance because one packing of grease will usually last for three to six months, whereas regular ring oiled bearings should be oiled every few days. The importance of correct oiling of all main lines and countershafts cannot be stressed too much. Oiling and greasing should be under the direct supervision of the millwright foreman so that he



Figs. 16, 17, 18, 19. No matter how excellent the type of fastening used, it must be correctly applied. Above are good and bad applications of rawhide lacing, and below good and bad applications of wire stitching.

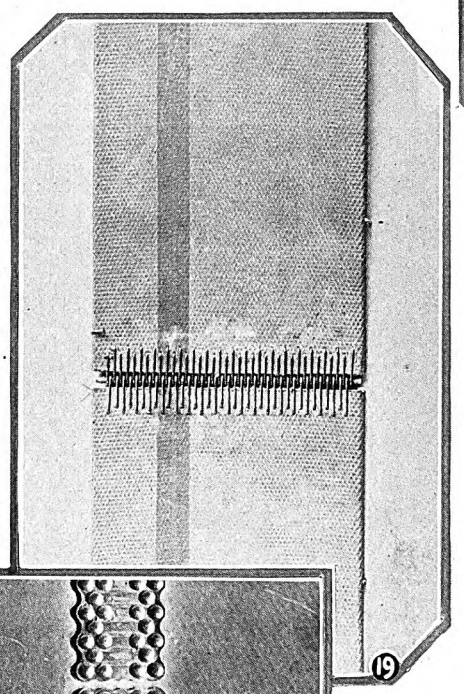
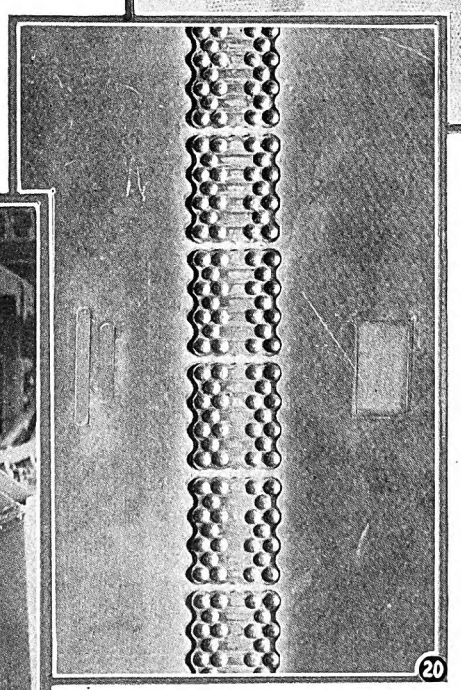


Fig. 20. Proper belt joining is good for the life of the belt, as is indicated in this case, where the belt has had many years of severe service and is still carrying its power.



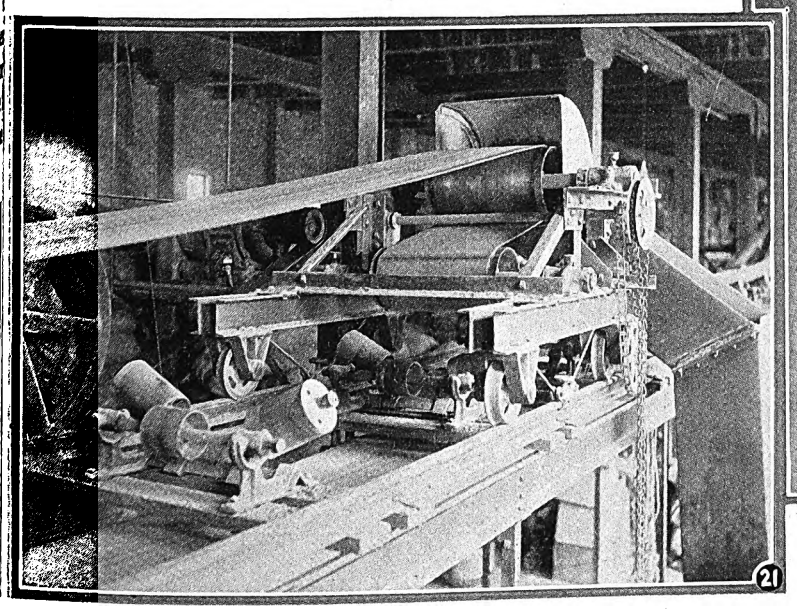


Fig. 21. The problem of joining belts applies as critically to conveyor belts as to power transmission belts. Here is an example of a grain elevator conveyor which delivers 4,000 bushels per hour. Note the fastening.

alone can be held responsible for the condition of the transmission equipment from the motor belt to the spindle of every machine in the plant. The electrician has the job of keeping the motor pulleys turning, and the machine repair department has the job of keeping the machines working properly, but in between these two points the millwrights have the mighty important job of keeping the wheels turning day in and day out.

The small gear or rotary pumps which are used on many machines to pump oil or a solution into the work, can be taken care of by the machine repair department or by the millwrights. However, a great deal of the trouble with these pumps is belt trouble, and it is therefore expedient to let the millwrights take care of them. If convenient, the machine repair department can issue to the millwrights a few spare pumps which can be used to replace any pumps that have to be taken off. This method never holds up a machine more than a few minutes.

There are two general types of countershafts, the tight and loose pulley and the friction clutch types. The bearings on loose pulleys, if plain bearings,

(*Continued on page* 51)

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Research and Industrial

By L. A.

Engineer, Research Laboratory,

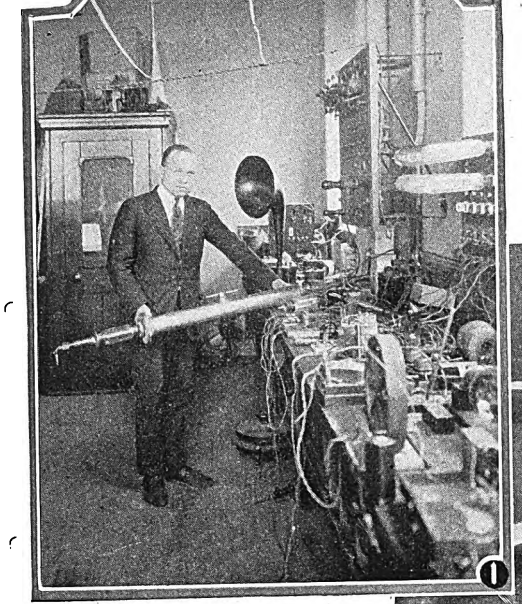


Fig. 1. This 1,000 KW vacuum tube is "big brother" of the one so familiar to radio enthusiasts, and holds some fascinating possibilities for power conversion.



Fig. 2. The young lady at the right is taking photometric readings, in the research laboratory.

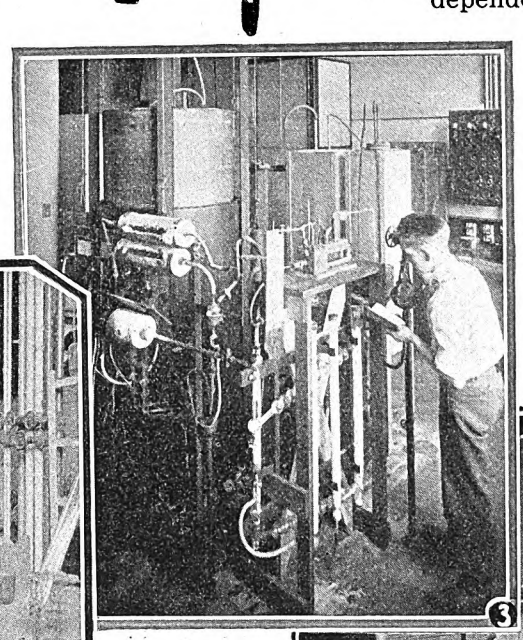


Fig. 3. At the left—here Argon, a rare gas whose value is of comparatively recent discovery, is being purified.

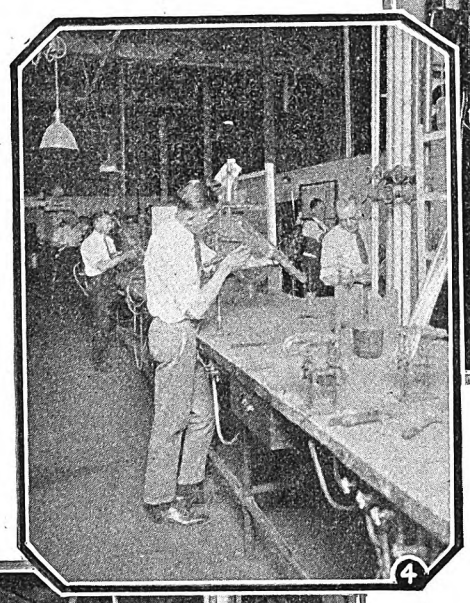


Fig. 4. Below—The modern version of the Venetian art: the glassblowers' room in the research laboratory.

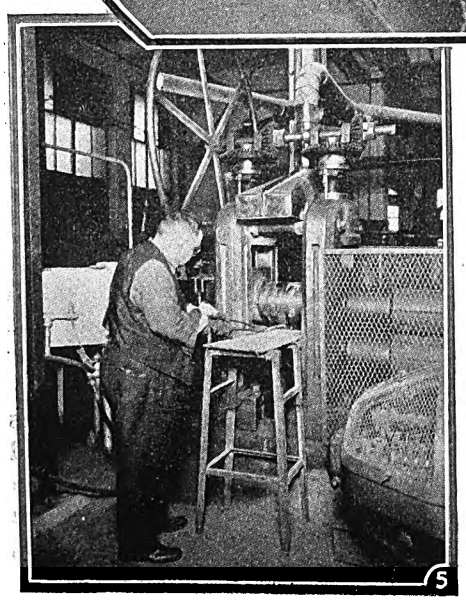


Fig. 5. At the left—Rolling tungsten sheet, in the laboratory. This is one of the things which, a generation ago, was among the impossibilities.

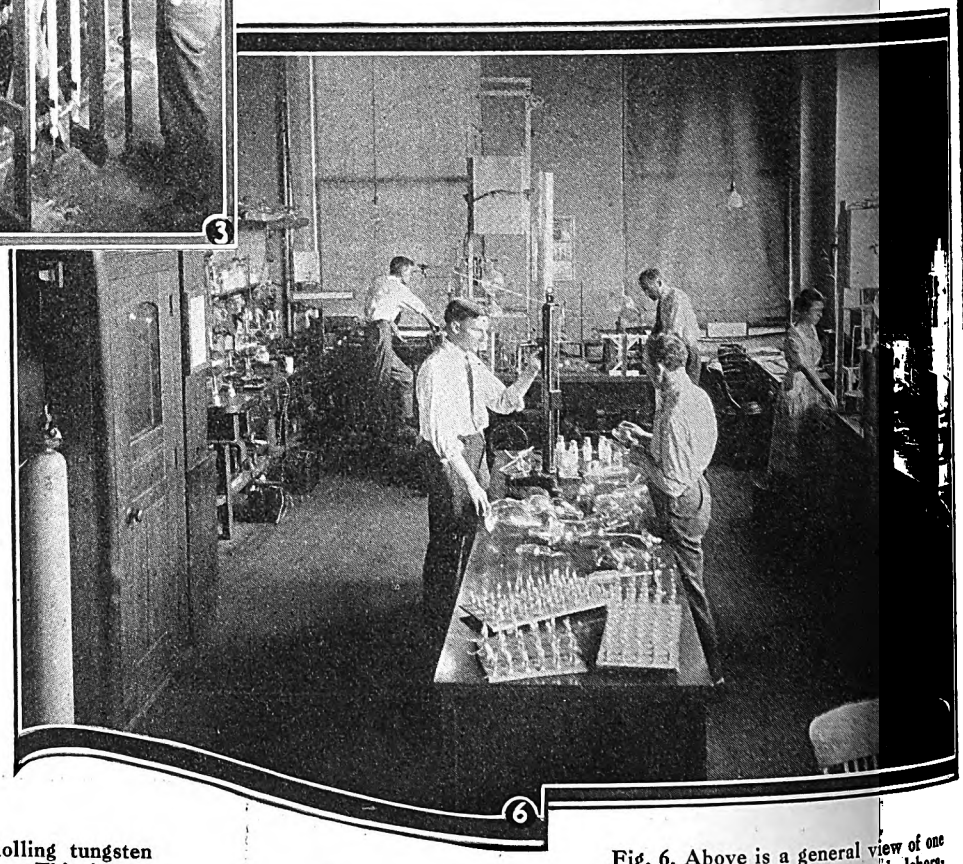


Fig. 6. Above is a general view of one of the rooms in the research laboratory. It would be hard to estimate the actual dollars-and-cents value of this organization.

TO write something worth reading about research is more difficult today than it was twenty or even ten years ago. Then industrial research was a novelty. The large industrial laboratories in the United States, though growing in number, were still few, and in England there were practically none. Some splendid research work was in progress in university and private laboratories in England but in America there was very little.

Then came the war, and almost at once the world learned to what an extent it had become dependent on the industrial laboratories of Germany. Dyestuffs, medicines, chemical reagents, optical glass, instruments, laboratory supplies, magnesium, special alloys, potash, were among the supplies cut off by the strangle hold of the British fleet. In Allied and neutral countries alike chemists and physicists were called from universities into the service of government and of industry to seek to develop the art of producing the equal of or substitutes for the German materials no longer available. Such hastily organized research was always costly and usually inefficient. Meanwhile the German laboratories were quickly and effectively engaged in producing substitutes for the materials denied to Germany by the British blockade, substitutes without which the war could not have lasted as it did, and in developing new and terrible weapons of offense.

So, among the lessons which Germany taught the world was the value of the industrial labor-

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the Modern Laboratory

HAWKINS
General Electric Company

atory. In England and in the United States alike the firm resolve was made never again to permit a possibly hostile state to obtain such a monopolistic eminence in the industrial applications of science. Even during the war, plans were formulated for ambitious and permanent research programs, and no time was lost after the armistice in putting those programs into effect.

Every large industrial corporation organized its own research laboratory. National Research Councils were formed to promote coöperative research by those industries in which the companies engaged could not afford individual laboratories, and to try to coördinate for better efficiency the work of the existing laboratories. Universities hastened to establish research departments to train the men demanded by this new scientific growth. Even the American Federation of Labor, realizing that the high wages and shorter hours won during the war could be retained in peace only through increased efficiency in production, passed resolutions and memorialized Congress urging national support of industrial research. Papers, magazines, and books have been filled with dissertations on the value of research, and countless addresses have been made in furtherance of its extension, until now there is danger that the word research may become as obnoxious through repetition as the word coöperation became during the war. And it is a real danger.

Also, there are many specific

(*Continued on page 69*)

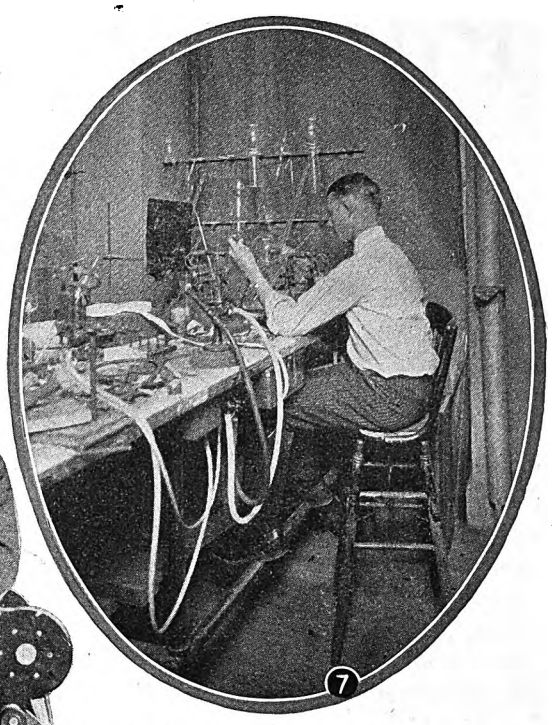


Fig. 7. Above—The glassblower is an indispensable adjunct to the research work.

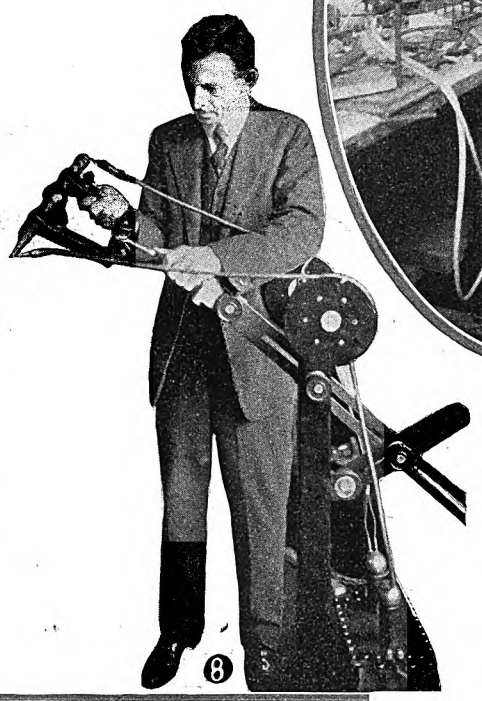


Fig. 8. At the left—Dr. Coolidge, with one of the portable X-ray machines. The picture is somehow reminiscent of visits to the dentist.

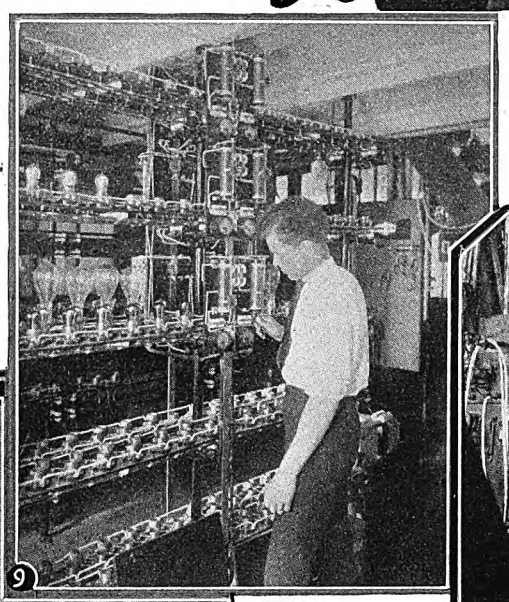
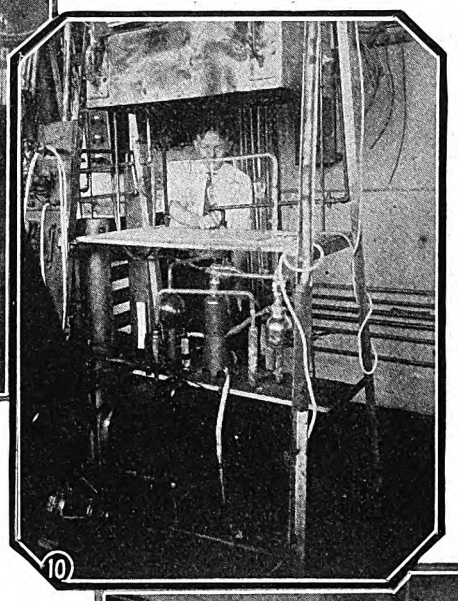


Fig. 9. At the right—Here our ubiquitous companion, the radiotron, is being tested.

Fig. 10. Below—Exhausting the air, preliminary to sealing and attaching the bases of the now familiar radiotrons used in broadcast reception.



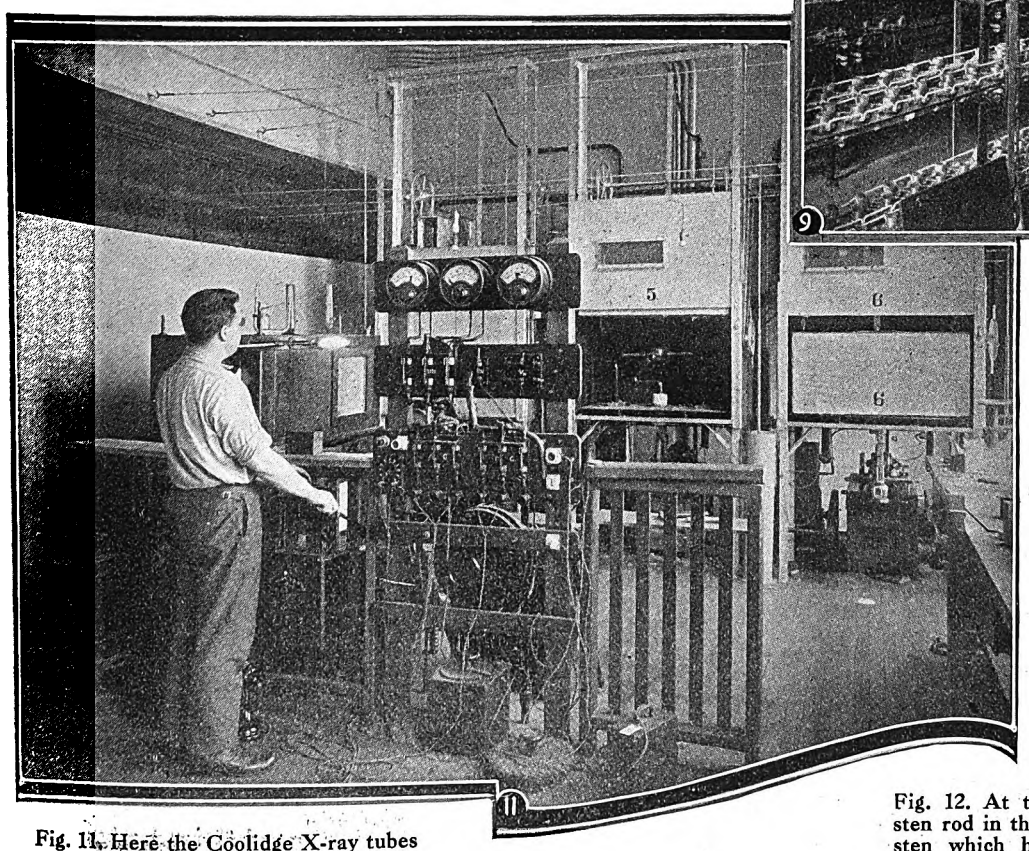
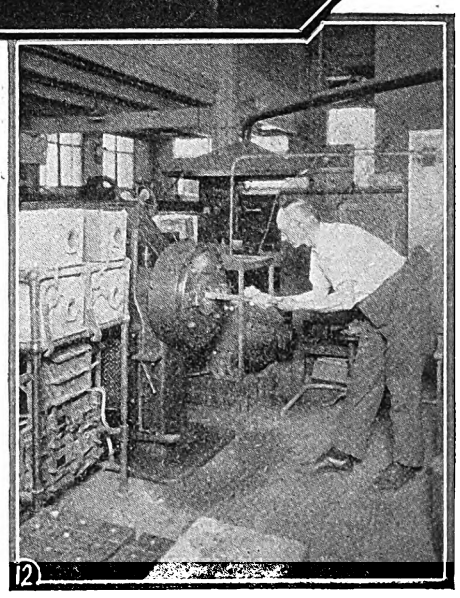


Fig. 11. Here the Coolidge X-ray tubes are exhausted to a high vacuum. How many of us stop to think of what the modern X-ray apparatus means to our general health?

Fig. 12. At the right—Swaging tungsten rod in the laboratory. It is tungsten which has divided our electric light bills by four.



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Piling Up Goods—and Profits

Making Full Use of Overhead Storage Space

By Matthew W. Potts

PREVIOUS articles by the writer appearing in this magazine have laid great stress on the common labor shortage, and continually pointed out how mechanical power will provide plenty of common labor cheaply and quickly. While materials handling equipment has been given the misnomer "Labor Saving Equipment" it is now being found by its more extensive use that greater savings are being made in money, time and space than by the actual elimination of labor. For this reason, the more universal term now being employed is Materials Handling Equipment.



Fig. 1. By providing machines to assist men in piling, the value of this storage space was increased 200 per cent.

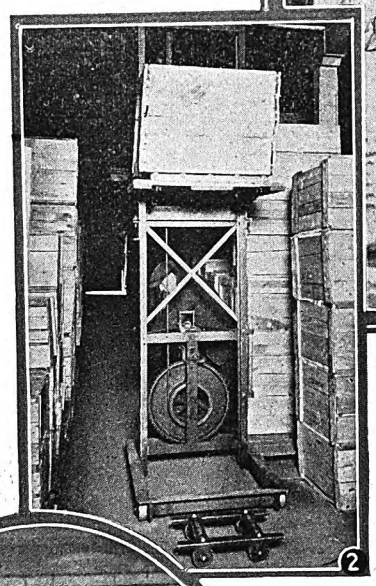


Fig. 2. Narrow aisles and high piles reduce cost of storage if mechanical methods of piling are employed.

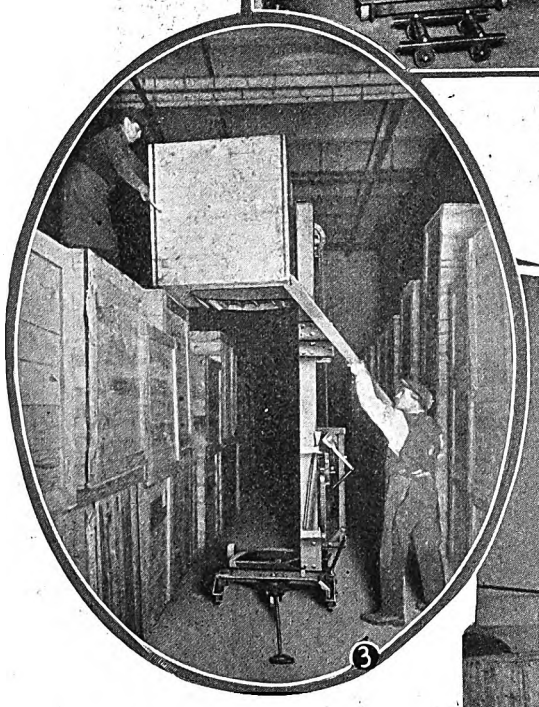


Fig. 3. In removing heavy cases from the machine platform, the operator can assist the piler as shown.

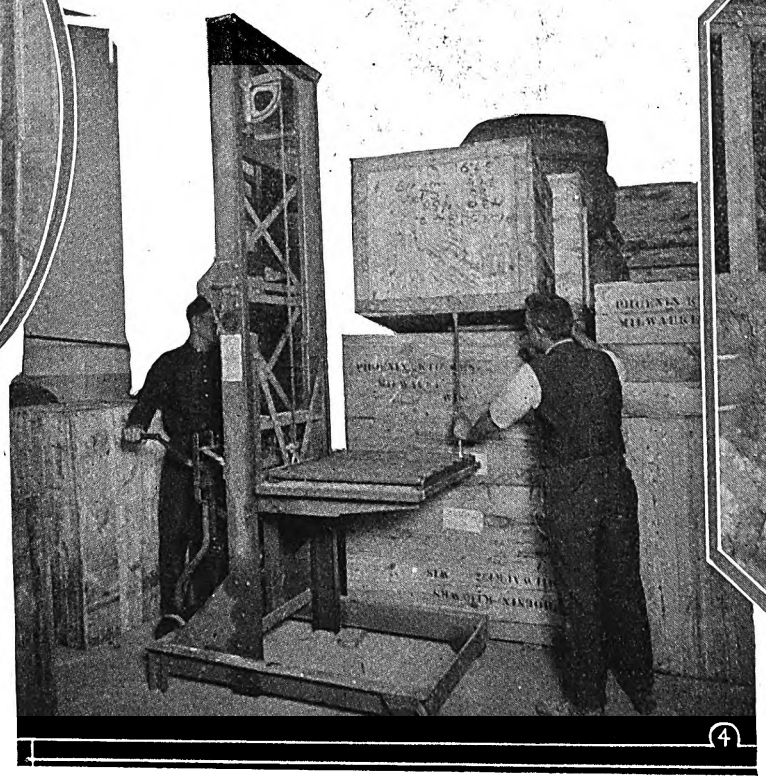


Fig. 4. Method of raising case with machine to remove or insert pipe roller, which facilitates handling, if heavy goods are being piled.

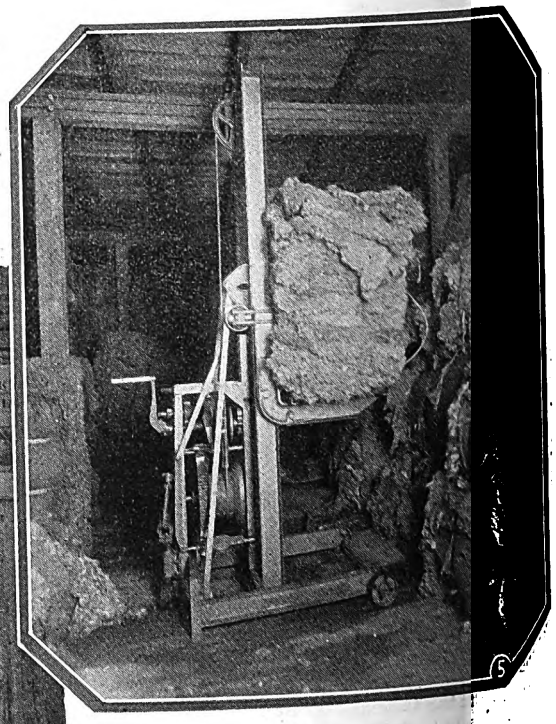


Fig. 5. Piling bulky and loose bales of materials is costly unless done by machine equipment.

Many instances have been illustrated showing the large money savings effected by the installation of this equipment, and it can readily be seen from these same illustrations that the machine equipment performs the operation quicker than manual labor, thus saving time; and one or two illustrations have been shown where the installation of this equipment has saved valuable floor space in manufacturing departments.

It is not only in the manufacturing or process departments that floor space is valuable. The various plant warehouses and storerooms now present great sources of extravagance in space. Many plants provide special buildings for storing their products. By making a survey, it will be found that all of this floor space is not used to the best advantage. The buildings are generally single story with plenty of overhead

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Fig. 6. Hand methods of piling in this case would be impossible, but the electric machine and two men accomplish this task with ease.

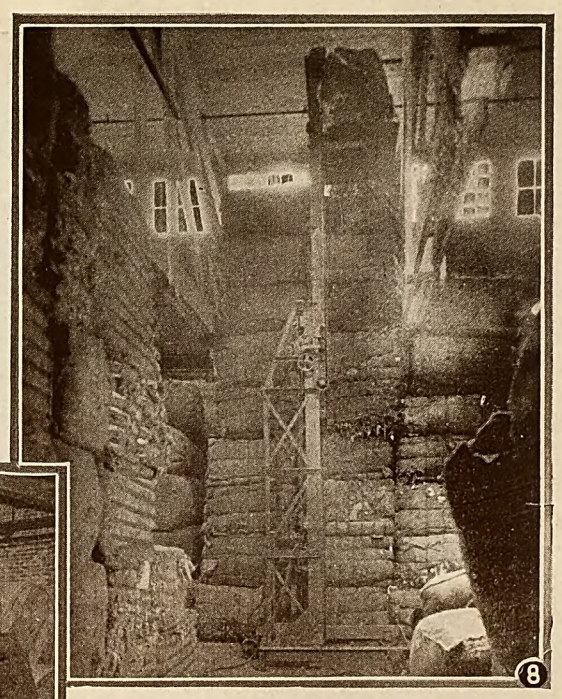


Fig. 8. In extremely high piling, or for piling between roof trusses, a telescoping machine saves considerable time and space.



Fig. 7. Hogsheads of tobacco, because of their bulk, used to be piled only one or two high. In modern tobacco warehouses they are piled in tiers four high.

space, or they are multiple story buildings, with ten or twelve foot head room.

It is true that frequently the allowable floor loads will not permit the high piling of materials, but more often the waste of valuable overhead space is due to the cost of piling materials higher than a man can reach, or to the inconvenience and bulkiness of the packages to be piled. In the piling and storage of materials in industry, despite the number of successful installations of materials handling equipment on these operations, there is still a large percentage of the work being done by old hand methods. Manufacturers do not seem to realize that every time a laborer handles their boxes, bags, bales, barrels, etc., his labor cost adds just so much to the indirect expense as an item in the cost of the goods. In fact, the goods go into the market burdened with an expense that competitive goods handled by machinery do not have to carry.

Such non-productive expense is unnecessary, however, for the development of piling machines and better storage methods has reduced piling costs, saving from 50 to 75 per cent. over hand methods by reducing the number of men required, and at the same time speeding up the operation, and doing the same amount of work in from one-third to one-half the time. These machines, furthermore, make all the storage space available, thus making it possible to store goods to the highest points allowable, even to the very ceiling, and to pile the packages flush with the aisles.

Machine equipment will generally enable one man to lift with ease packages that would tax the strength of four to eight men, and this reducing of the

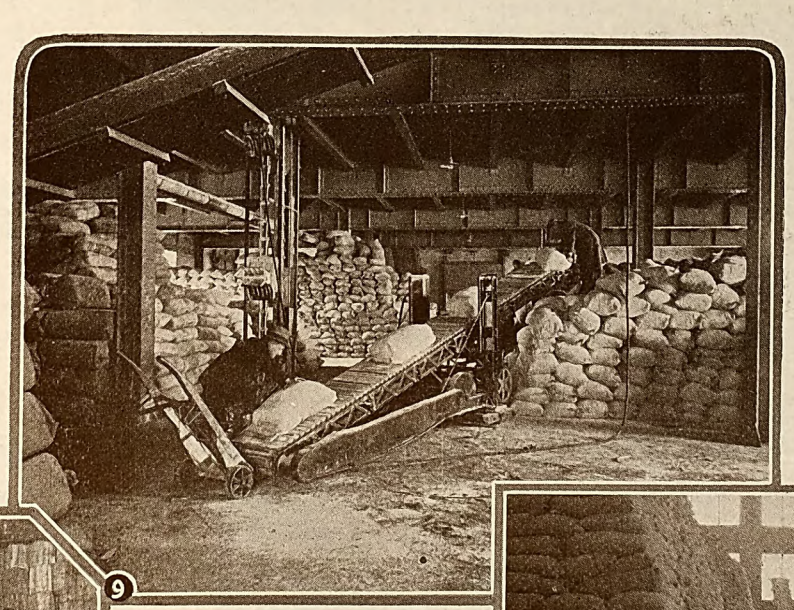


Fig. 9. Piling bags by hand is expensive, with portable conveyors costs are reduced.



Fig. 10. Portable conveyors furnish a continuous stream of bags to the top of the pile. Additional sections can be added as shown.



Fig. 11. Bundles of barrel staves provide an insecure footing for men when piling. The conveyor eliminates accident hazard.

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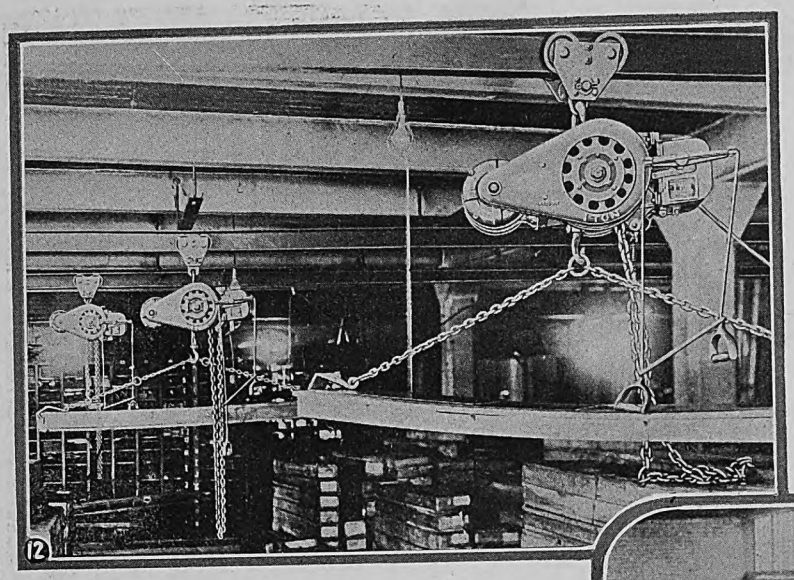


Fig. 12. A monorail and electric hoist provides the best method of handling large sheet metal.



Fig. 13. Barrels of dry materials can be piled in straight lines as shown.



Fig. 14. Materials stored by this method waste valuable overhead space.

working force is an insurance against labor shortage and labor turnover. Materials handling equipment makes the laborious work of piling so easy that the best workers stay, because they realize the advantage of working with a machine, instead of doing the heavy work by hand. When laborers are piling goods, there is considerable waste time waiting for trucks to bring materials to the pile. It is seldom that there is a continuous stream being delivered to the piling gang, and even if this condition could be brought about, it would be necessary every few minutes to give the men a rest.

Unused space and excessive labor costs in the storage warehouses, both for raw materials and finished products, are eating into the profits of a number of industries. In order to see quickly the savings that can be made by the use of some form of materials handling equipment, we will look at figure 1, where a hand-operated portable ele-

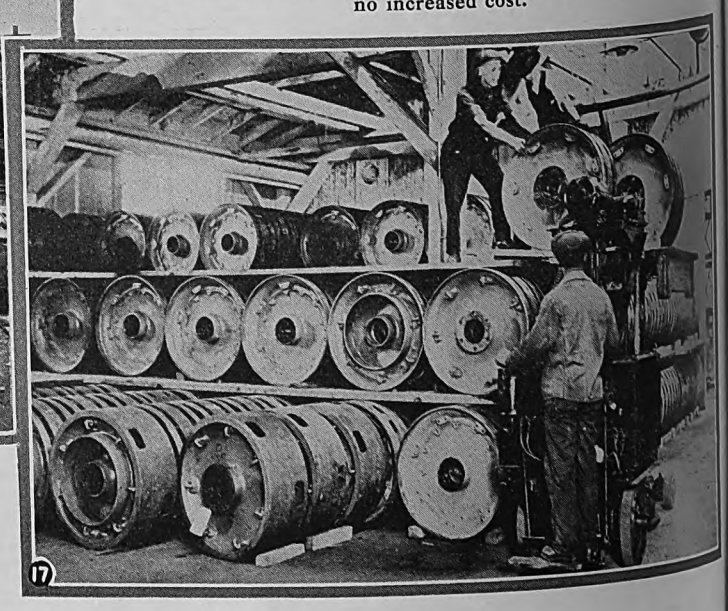


Fig. 15. Installation of racks permit liquids in wooden barrels or metal drums to be safely stored, and utilize all overhead space.



Fig. 16. Racks can be erected before the building, or afterwards to fit conditions.

Fig. 17. Tiering heavy motor truck wheel castings (700 lbs. each) three tiers high instead of one, increased storage capacity 200 per cent., at no increased cost.



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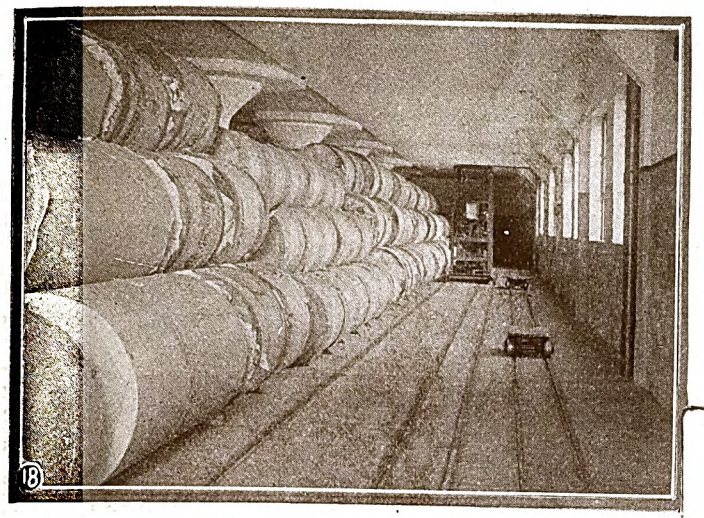


Fig. 18. General view of piling machine and handling methods in paper storage room of large newspaper establishment.

vator is being used to raise coils of rope, weighing over 700 pounds each. Previous to the purchase of the equipment, this rope was never stored over one high, since it required four men to lift the coils up to the second tier, thus making the piling cost prohibitive. Now, through the use of the machine illustrated, the coils are piled three high, thus utilizing all available head room and increasing the storage capacity of warehouse space by 200 per cent.

The ability of this machine equipment to work in narrow aisles and to pile the goods as high as desired, makes all space available, and every inch earns its pro rata of the cost of the entire space. Figure 2 shows how one man can handle case goods to a height of over eight feet, without any other assistance. Figure 3 shows how, if the packages are heavy, or extremely bulky, the machine operator can assist the piler in removing the package from the

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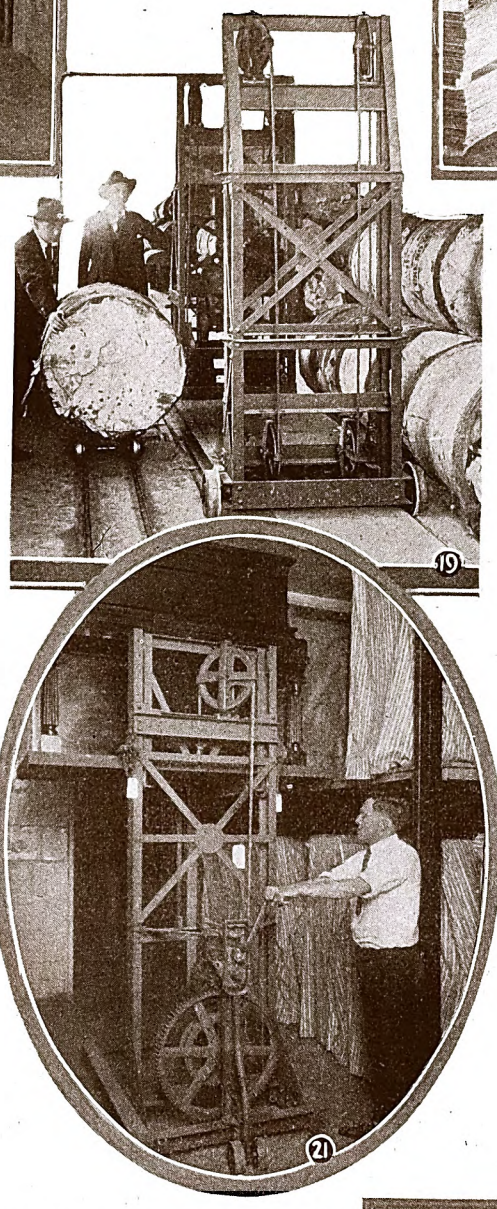


Fig. 19. Close up view of piling machines in Fig. 18 and method of loading and unloading same.

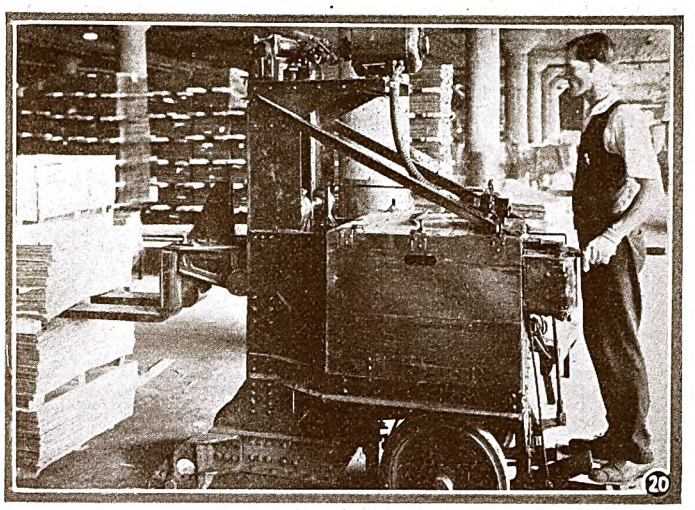


Fig. 20. Piling small sheet metal can be cheaply handled by special tiering truck.

Fig. 21. Piano storage in this factory was increased 100 per cent. by building a mezzanine platform.



Fig. 22. Wasteful method of storing machine parts in process, causing enormous losses in money, time and space.

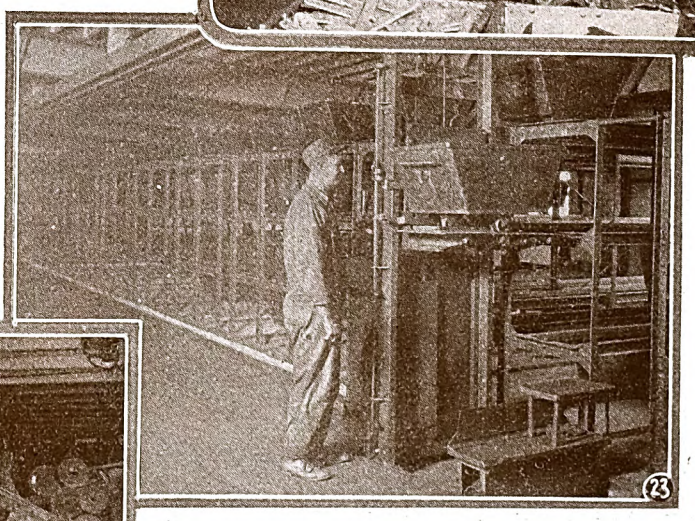


Fig. 23. The rack method now employed for storing materials, shown in Fig. 22, quickly paid for itself.

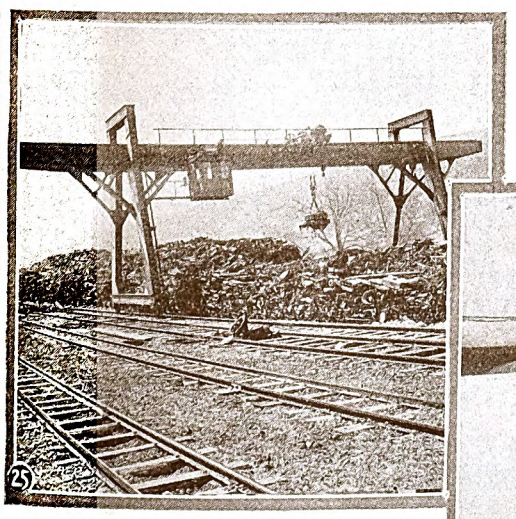


Fig. 25. What is true of inside storage is also true of overhead space and outside storage, where the pile should also be high.

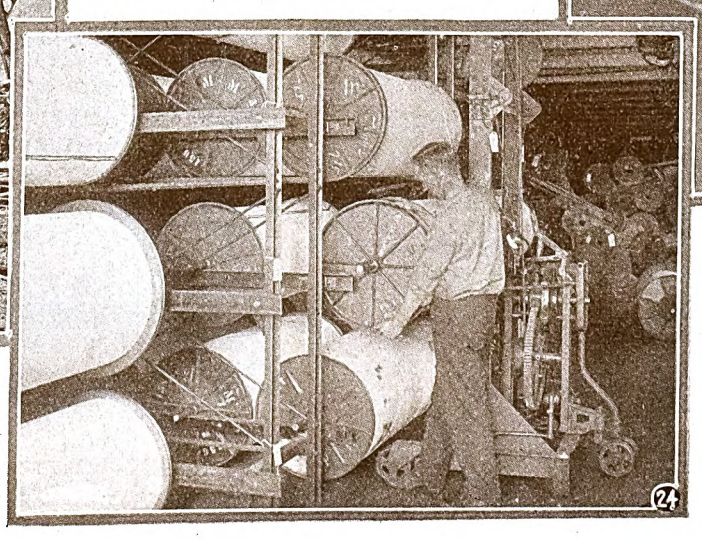


Fig. 24. This system of racks for storing warp beams has reduced handling costs, loss due to damage, and also saved time.

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What Do You Pay for Steam?

Checking Costs and Losses in the Boiler Room

By James T. Beard, 2nd

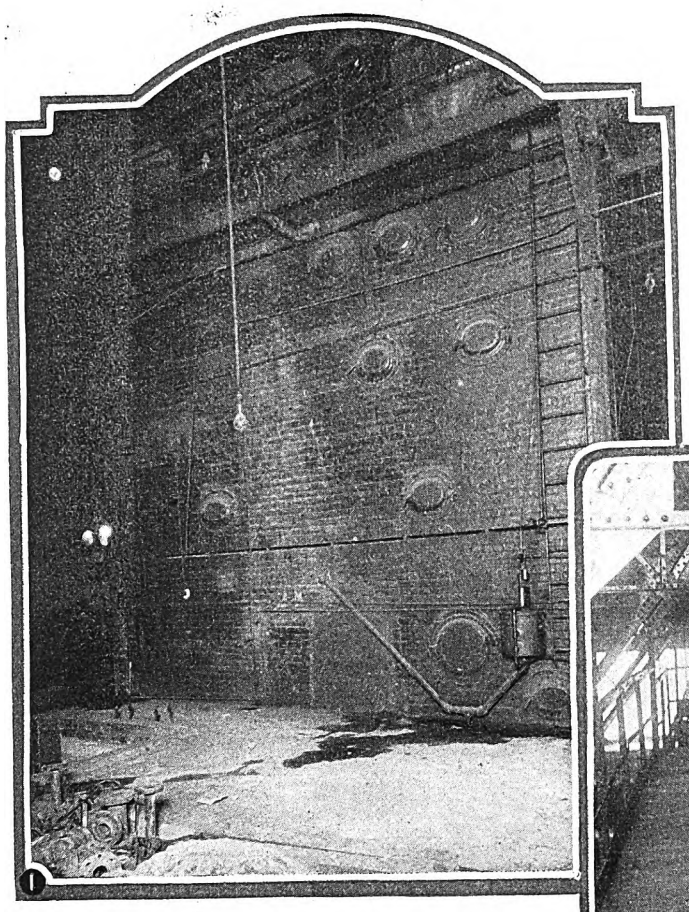


Fig. 1. Automatic damper regulator, which controls the draft condition in the furnace and which often results in considerable increased average combustion efficiency. Such a device takes some of the "human element" out of boiler house operation.

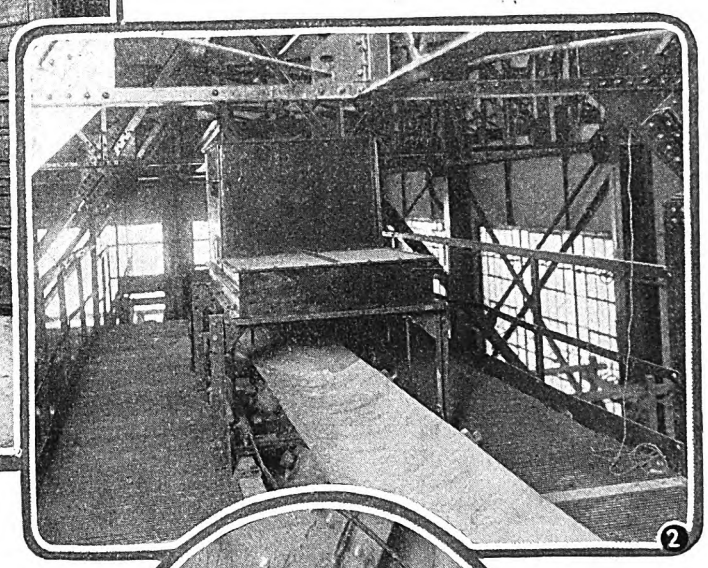


Fig. 2. It is not sufficient to know how much coal you buy by actual railroad weights. It is equally necessary to know how much coal you burn by boiler house weights. Where coal conveyors are used, an automatic scale records this weight continuously.

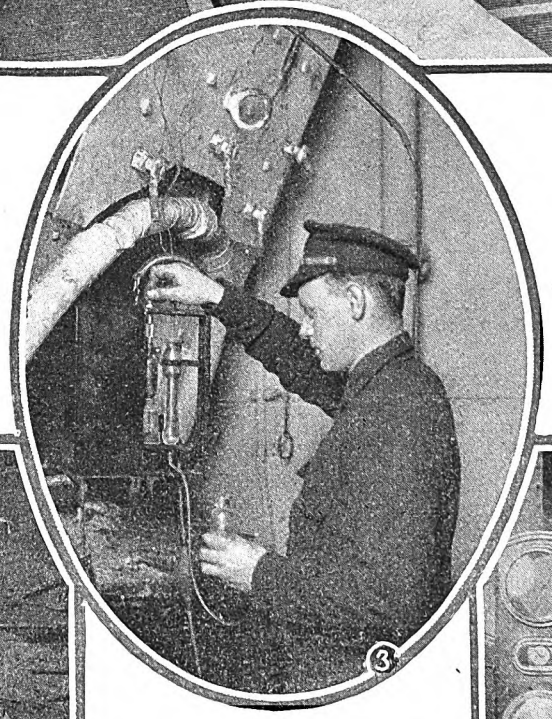


Fig. 3. Correct firing and draft conditions cannot be fully determined without a fairly accurate check upon the percentage of CO_2 in the flue gases. A simple instrument for quickly checking these readings is the hand Orsat.

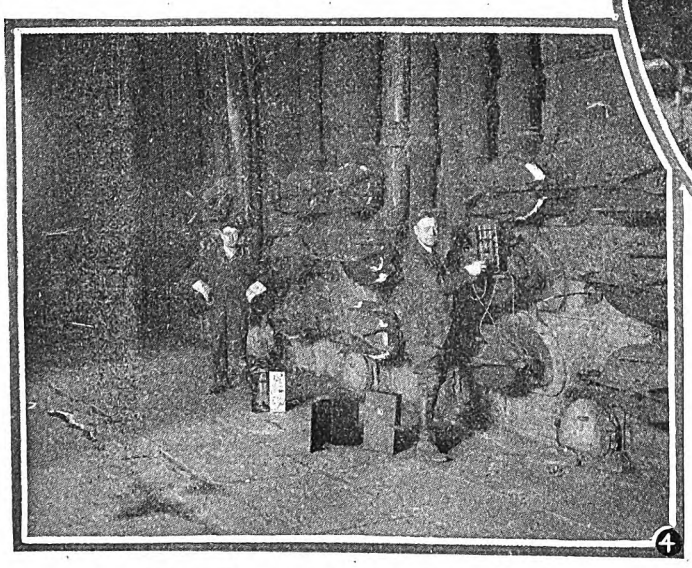


Fig. 4. The Orsat is a necessary instrument, not only in periodic tests frequently conducted in the boiler house, but also in checking the daily operation of the plant and in determining the correct drafts and thickness of fuel bed. Where recording instruments are used, the hand Orsat is valuable in checking their readings from time to time.

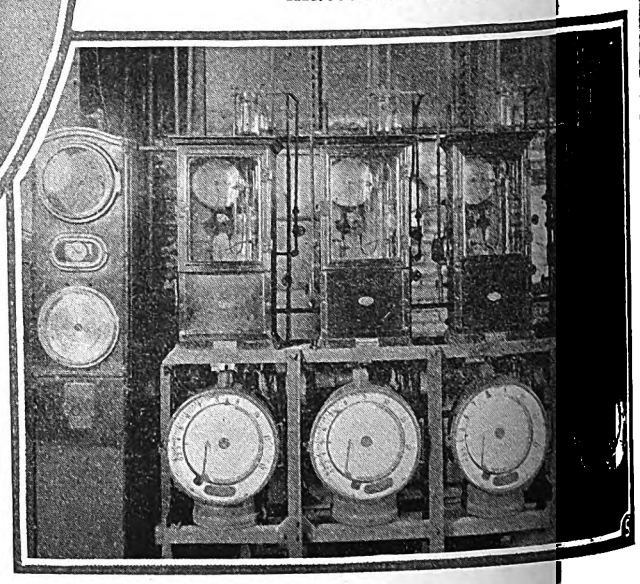


Fig. 5. A battery of CO_2 recorders and steam flow meters serving the boilers in a large industrial plant in the Middle West. Note that a venturi meter is located at the left for measuring also the amount of feed water delivered to the boilers.

There is no good reason why the boiler house of the industrial plant should not be just as profitable as any other department of the plant. Considering it as a unit by itself it is a complete factory for the manufacture of steam. It seems entirely logical, therefore, to expect that, with intelligent management, it should show a profit, just the same as the major enterprise is expected to show a profit.

In the average boiler house, however, this is not apt to be the case. The steam factory is thought of more or less as a necessary evil. There is perhaps not more than one industrial plant in ten that can answer correctly the following simple business questions with regard to their steam power production costs:

1. What does it cost to generate 1,000 pounds of steam?
2. Is this cost excessive for the particular local conditions?
3. If excessive, can it be reduced, and how?
4. Would it be good business to purchase power outside?

There are many reasons why we should expect that a well conducted plant would be able to answer these questions. Boiler room operation is a business, just as much as any industry is a business. In the manufacture of steam under pressure, certain raw materials are essential. With suitable equipment and by a well defined process these raw materials are converted into the finished product, having a definite marketable value. If this secondary enterprise of ours does not show a profit, we have a right to know why.

Boiler house accounting is a matter of "debits" and "credits,"

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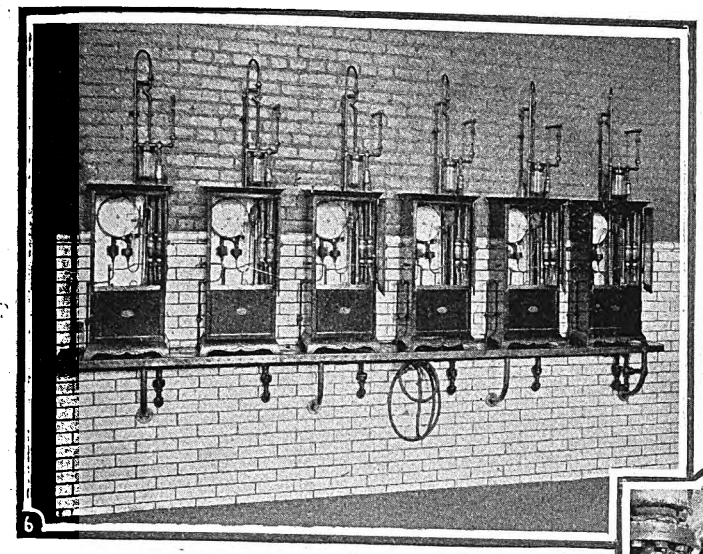


Fig. 6. Where the size of the plant warrants the expenditure, individual CO_2 recorders for each boiler unit give a splendid arrangement. Accurate and continuous check on everyday performance is thus possible.

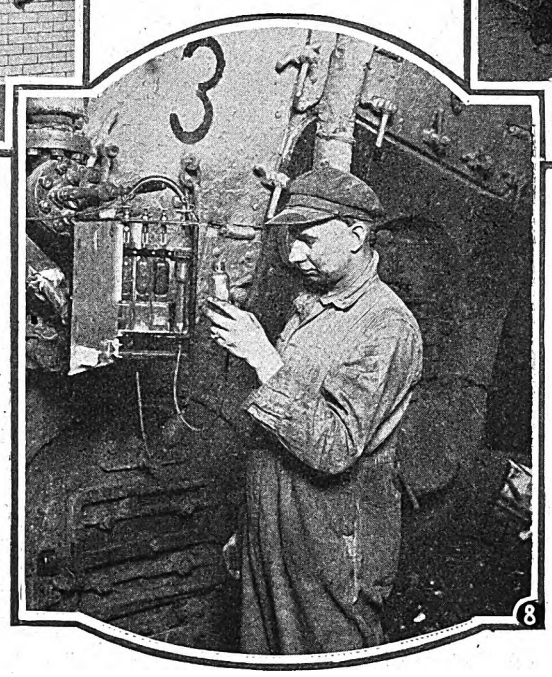


Fig. 8. Even on shipboard the hand Orsat is recognized as a valuable indicator of combustion efficiency. Small industrial plants which cannot afford elaborate instruments are also well served by its intelligent use.

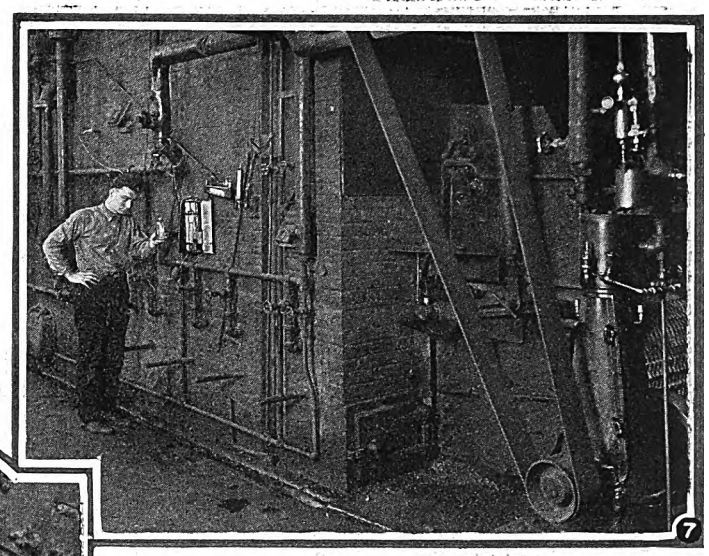


Fig. 7. A simple draft gage in conjunction with a hand Orsat are the most valuable instruments in a boiler room. Quicker results in boosting operating efficiency may be attained by their intelligent use than by any other similar combination of instruments. They not only detect wrong conditions, but when their readings are correctly interpreted, they indicate the source of trouble.

just the same as for any other plant department. So many heat units in the form of coal are delivered and debited against it. The chief engineer will be held to a strict accounting for every one of these units.

In the course of his day's run he turns out so many heat units in the form of steam power, for which he must be duly credited. But the limitations of his equipment, his men, and of the process itself, do not permit him to deliver unit for unit. There are some unavoidable operating losses, with which he must also be credited. His job is to keep the operating losses at a minimum and maintain the heat units delivered in steam at a maximum. The entries would look something like this:

CR.	B.t.u.
50 Tons Coal, 100,000 lb. at 12000 B.t.u. per lb.	1200 Million
TOTAL	1200 Million
DR.	**B.t.u.**
720,000 lb. Steam at 100 B.t.u. per lb.	720 Million
Losses	480 Million
TOTAL	1200 Million

A statement like this from the chief places his department immediately on a businesslike basis. It means something definite. A second column on each side of the ledger could easily be added for the value in dollars and cents represented by each of these items.

Such a report could not be rendered with any degree of accuracy, however, without certain information as to plant performance. This information can be secured only by suitable instruments for the purpose.

Some method for weighing coal should be provided. In small plants a platform scale and wheelbarrow may be sufficient. In other plants a railroad scale may be desirable. Where coal conveyors are in service, automatic recording scales are convenient. In some stokered plants a traveling larry with suitable weighing hopper may answer the purpose best.

To determine the heat units in the coal, an actual representative sample of each railroad car should be taken and tested.

The chief must also have proper instruments for measuring the amount of steam he produes. Steam flow meters are easily installed and record with remarkable accuracy. Individual instruments for each boiler unit are desirable, but where

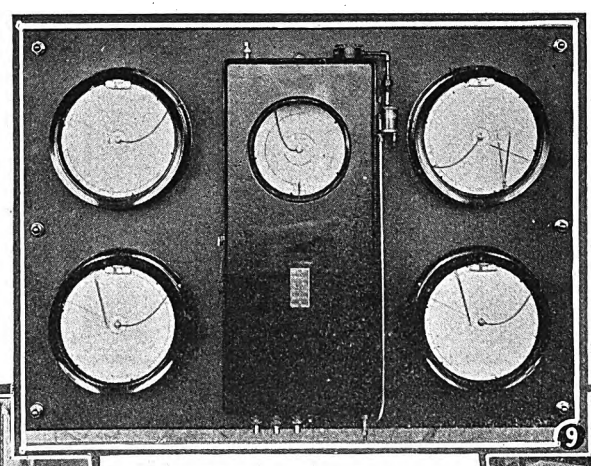


Fig. 9. An instrument board which gives visible information and a continuous record of feed water temperature, draft loss through the fuel bed, steam pressure and percentage of CO_2 in the flue gases.

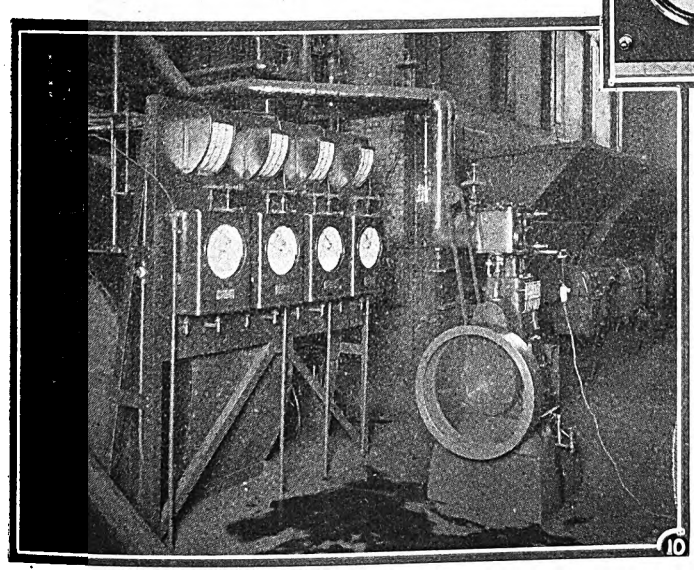


Fig. 10. Distribution of steam load between the various boilers is quickly indicated by individual steam flow meters. When a boiler is not absorbing its share, it is time to determine the cause and correct it.

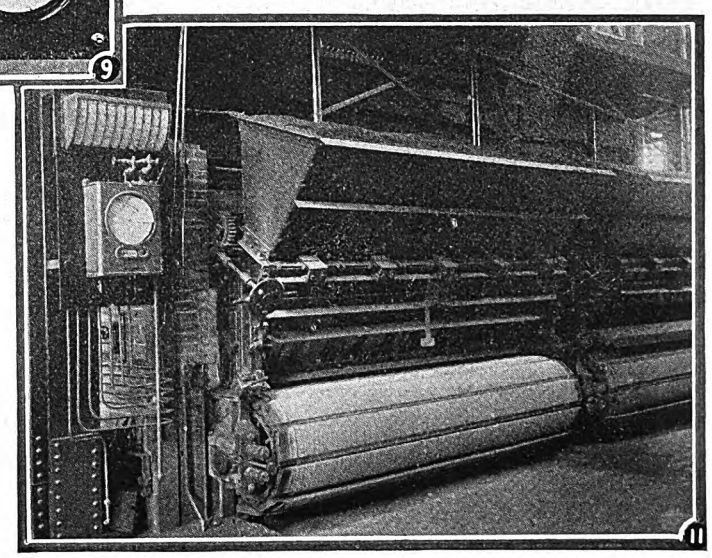


Fig. 11. Individual steam flow meters may be mounted upon the boiler fronts, where they may be seen from the boiler room floor. Meters of this type may also be used to indicate and record flow of feed water to the boilers.

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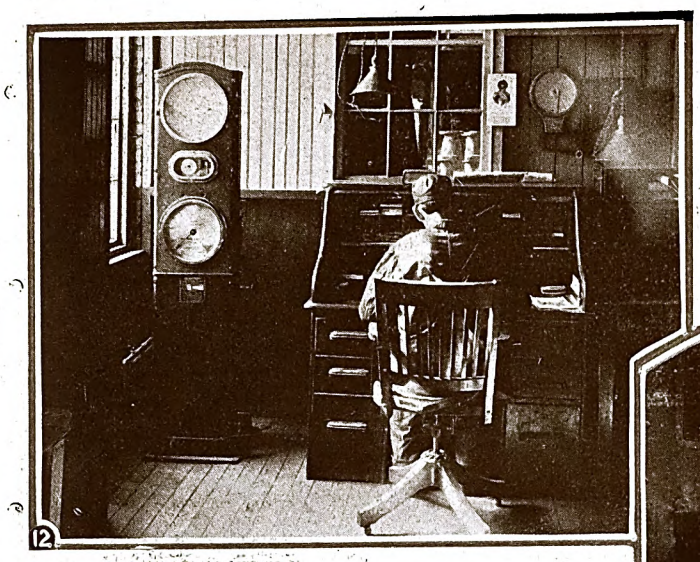


Fig. 12. A venturi meter may be advantageously located in the chief's office, where it is sure to receive proper attention and where the information gained will be used to best advantage.

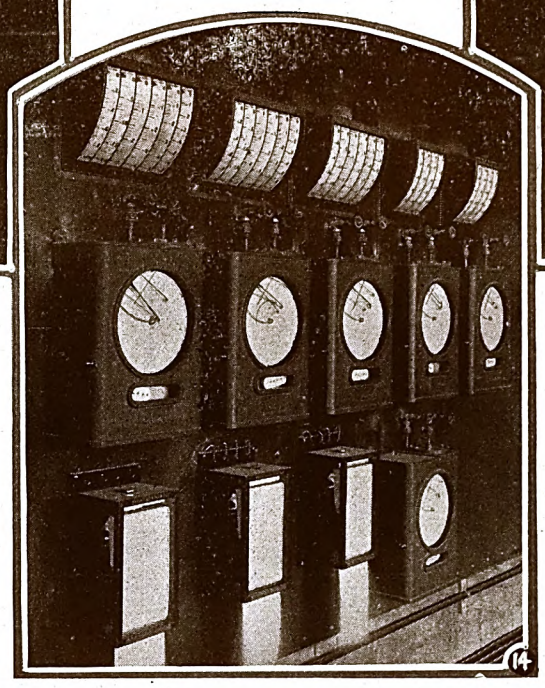


Fig. 14. An instrument board giving instant and continuous information on the amount of steam developed by each boiler, and the temperature of the gases leaving each boiler.

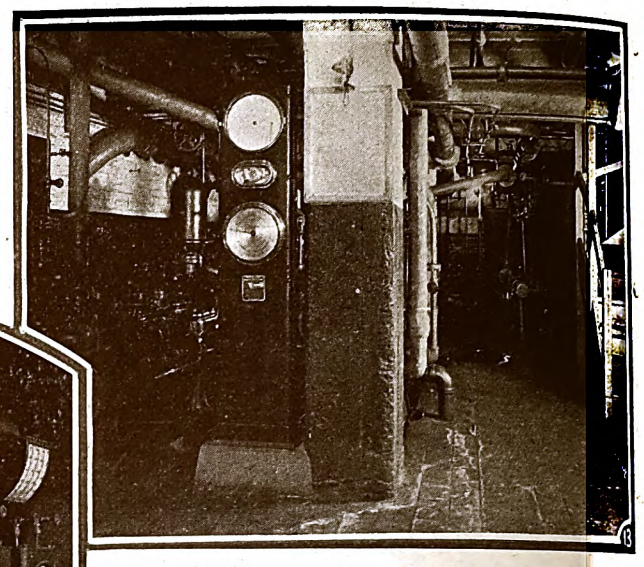


Fig. 13. Typical meter for measuring the amount of water fed to the boilers. In this case the instrument is located in the pump room, where the clean surroundings have a beneficial effect upon its service.

that expense is not warranted, the total steam generated in the plant may often be obtained by one, or perhaps two, meters properly placed. Another method of determining the quantity of steam produced is by recording the number of times a measured volume of feed water passes through the meter. Other types of feed water meters determine the quantity of water passing the meter by measuring its flow over a weir. Still others use the venturi and orifice methods of measuring the flow.

The measurement of the heat units in the steam can be safely left to the ingenuity of the chief, who can readily rig up a simple throttling calorimeter in the steam line. This in conjunction with his steam pressure gage and his steam tables will tell him what he wants to know.

With this simple equipment it is possible to balance total coal used against total steam generated and total plant losses every week or every month as the case may demand.

Valuable as this information is in comparing one month's performance with another, however, it does not tell a complete story. It merely indicates a general trend in plant performance. One month's losses are greater than another's. What were those losses? What were the causes? Were they excessive? How much can they be reduced? What steps should be taken to reduce them?

That is another story.

It is not sufficient, therefore, to know that there are losses. We must be able to control those losses, with a view to increasing useful production by eliminating preventable leaks and correcting wrong conditions.

To do this we resort to another record form, which the chief engineer should keep for his own information and guidance. Let us call it the Heat Balance.

In running down preventable losses, we are not interested in figures on total steam production, nor total coal consumption. But we do want to know how much heat in every pound of coal goes to the production of useful work. The balance is wasted and

(*Continued on page* 58)

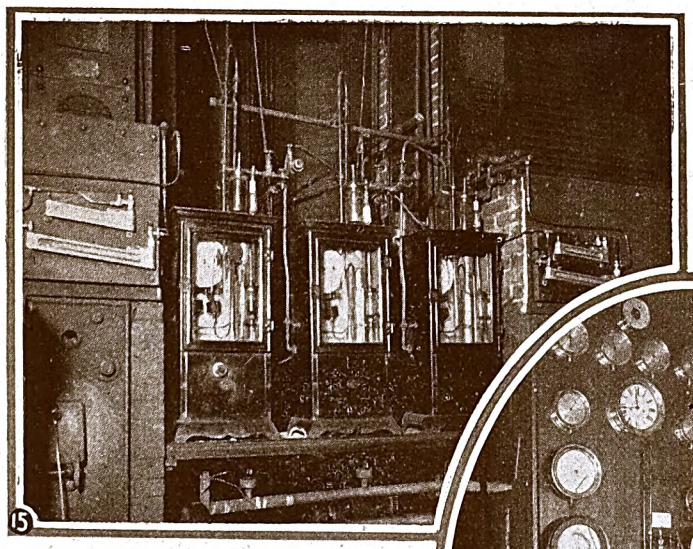


Fig. 15. A battery of instruments recording continuously the percentage of CO_2 in the flue gases. Where expense warrants, these watch dogs of the boiler are valuable assets to the chief. Note the differential draft gages for indicating conditions within the boiler setting.

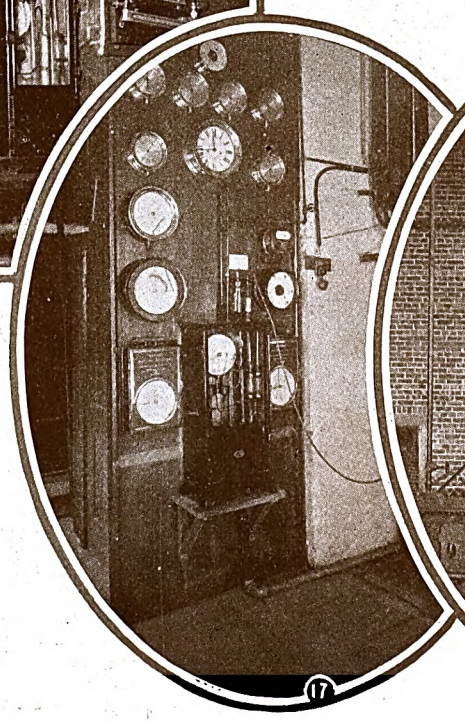


Fig. 17. Complete instrument board consisting of CO_2 recorder, flue gas temperature recorder, steam flow meter, feed water thermometer and various pressure and vacuum gages.

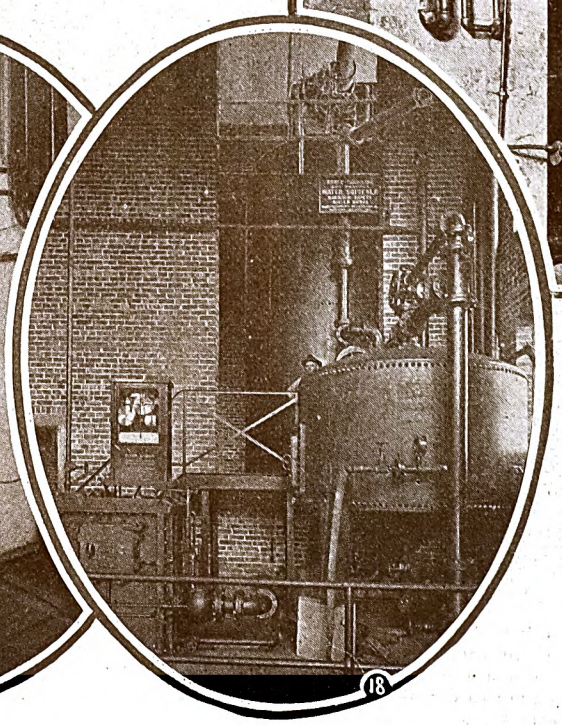


Fig. 16. When individual CO_2 recorders for each boiler are considered too great an expense, a single recorder may be installed in conjunction with individual automatic gas sampling cans.

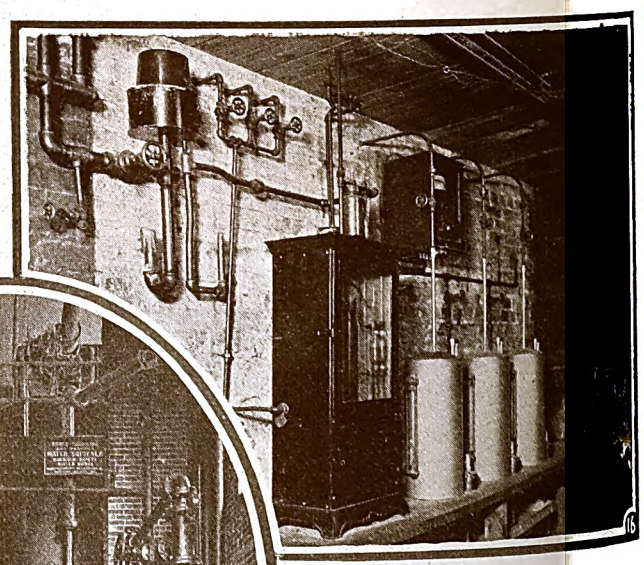


Fig. 18. Feed water may often be advantageously measured by allowing the water to flow over a correctly proportioned weir. An instrument for recording such a flow is shown in the illustration.

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Where Tradition Is Still a Handicap

Brick-Making, and Some of Its Surviving Antiquated Methods

By Reginald Gordon

IF you ask a bricklayer or a builder some question concerning brick walls or the market price of bricks, he will talk "brick" with you, always using the singular. He tells you that *brick* cost so much per thousand, that being the unit in dealings; or the number of *brick* in a wall of given dimensions, just as we speak of so many tons of *coal*. This is trade vernacular, similar to the English usage of *coals* where we say *coal*.

From the census of manufacturers of the United States for 1919, we learn that the sum of $355,848,355 was invested in the brick, tile, terra cotta and fire clay industries; and that 76,915 wage earners were employed in 2,414 establishments. The total output of these plants during the year mentioned was valued at $208,422,920.

According to a report issued by the United States Department of Commerce, August 31, 1923, the following tabulation shows the quantities of the various kinds of brick produced in 1922 and 1921, and their value:

	1922	1921
Common Brick, Thousands	5,895,615	4,547,900
(Value)	$72,715,640	$57,096,178
Vitrified Paving Brick, Thousands	410,633	468,945
(Value)	$8,967,273	$11,301,409
Other Vitrified Brick or Block, Thousands	75,820	93,000
(Value)	$1,277,998	$1,668,756
Face Brick, Thousands	1,407,853	873,346
(Value)	$28,537,504	$18,128,217
Fancy, or Ornamental, Thousands	15,964	1,996
(Value)	$306,493	$79,762
Enameled Brick, Thousands	16,458	12,756
(Value)	$1,313,633	$1,207,081

There were 1,651 establishments primarily engaged in the manufacture of brick, tile, terra cotta and fire clay products in 1922.

In spite of the ever widening use of concrete, brick continues to hold its own in building construction. In the New York City district alone, in 1922, the quantity of building brick received from yards along the Hudson River was estimated at not less than 720,000,000. In addition, enormous quantities of brick are made in the Middle, Southern and Mid-Western States; in fact, almost anywhere where suitable clay or shale is found at or near the surface.

The making of bricks from sun-dried and fire-baked clay dates back to remote antiquity. It is estimated that the process has been known to man for a period of from 4,000 to 6,000 years. The Assyrians, Egyptians and Babylonians made bricks; and the Chinese appear to have known how to produce hard burned bricks and even to have had a process for glazing them in various colors. In

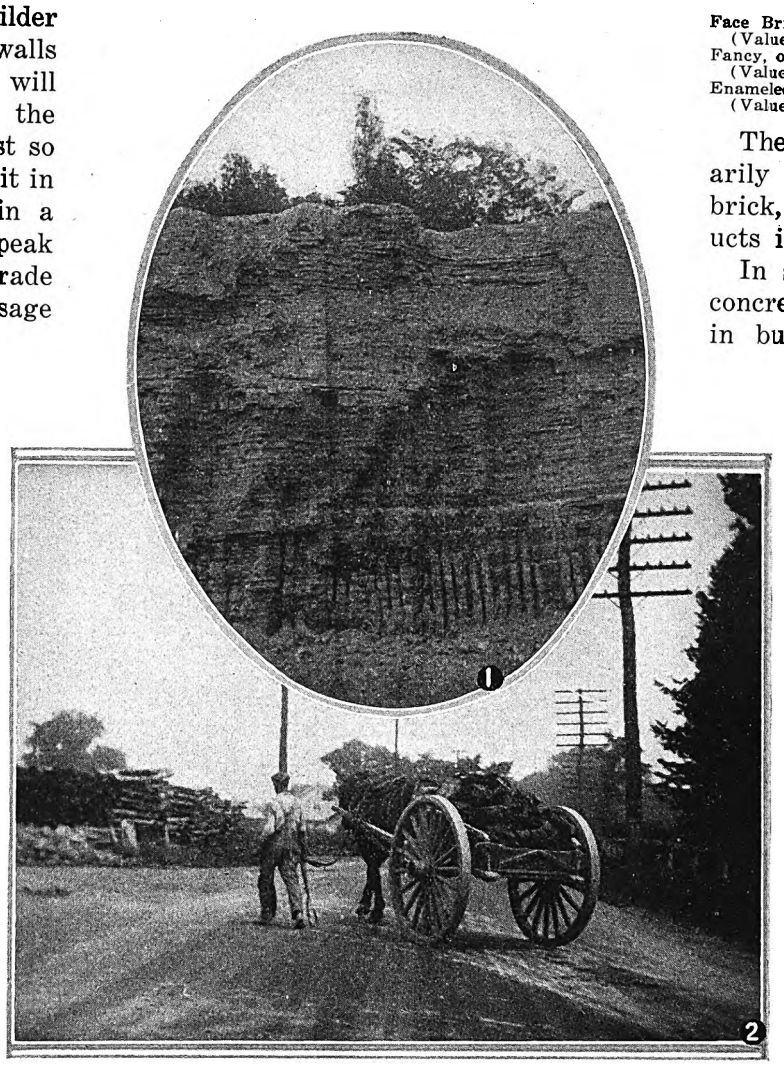


Fig. 1. A typical Hudson River clay bank. The clay is overlaid with strata of yellow shale, which must be stripped off in order to dig out the clay.

Fig. 2. In some localities clay is still carted from bank to mixing pits as shown here.

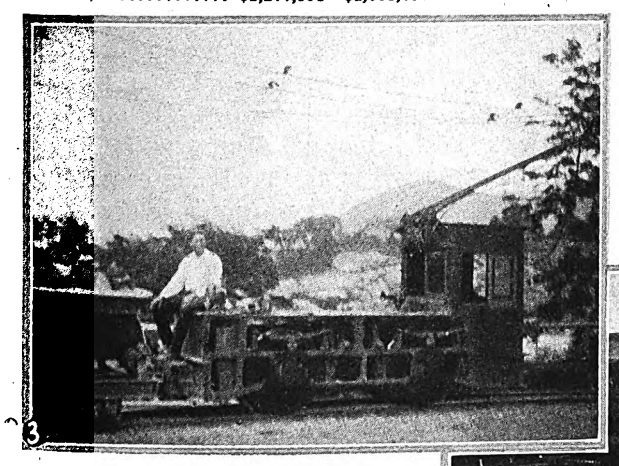


Fig. 3. Electric locomotive pushing a train of clay cars from the bank to the yard.

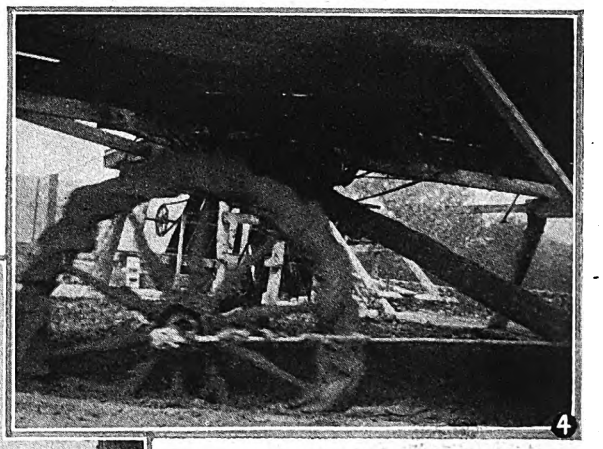


Fig. 4. The method of mixing or tempering the clay shown above has been in use more than one hundred years. The wheel, pulled around the circular pit by the hook, is shifted at each revolution away from, or nearer to, the center of the pit.

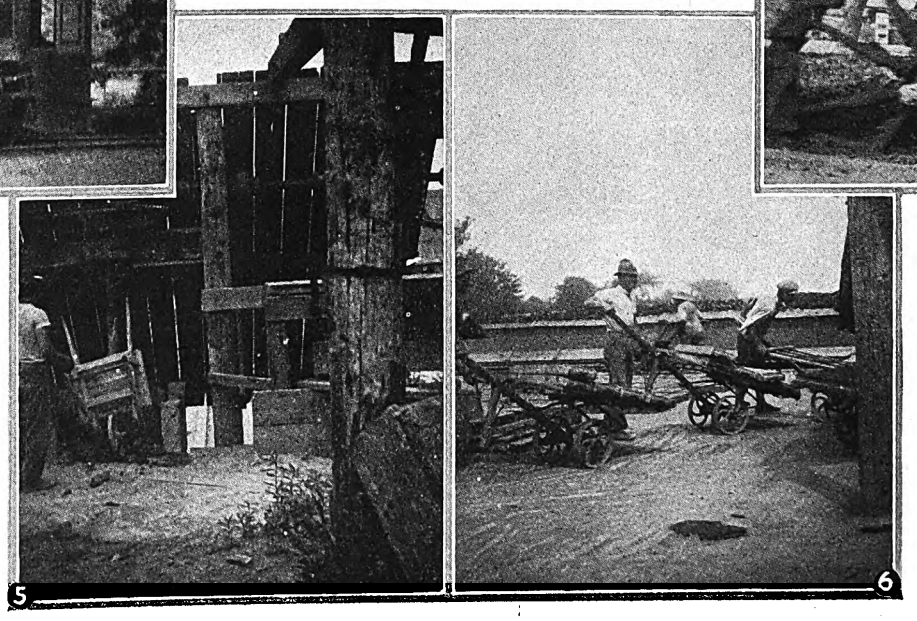


Fig. 5. Dumping prepared clay into the hopper of an old style pug mill.

Fig. 6. Truckers wheeling empty molds to a brick machine after dumping the molded brick on the floor of the yard.

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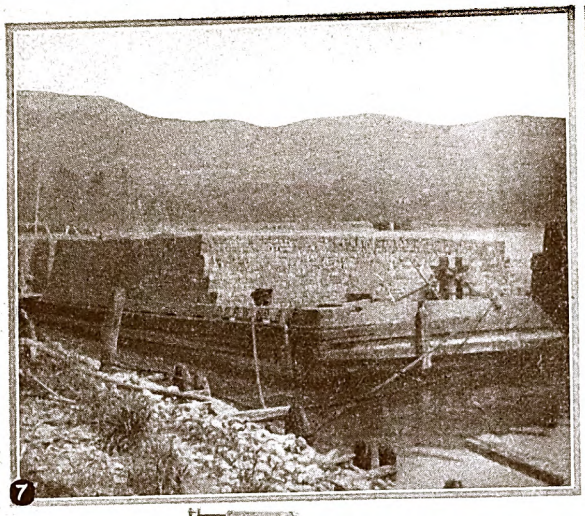


Fig. 7. 350,000 brick ready to be towed down the Hudson.

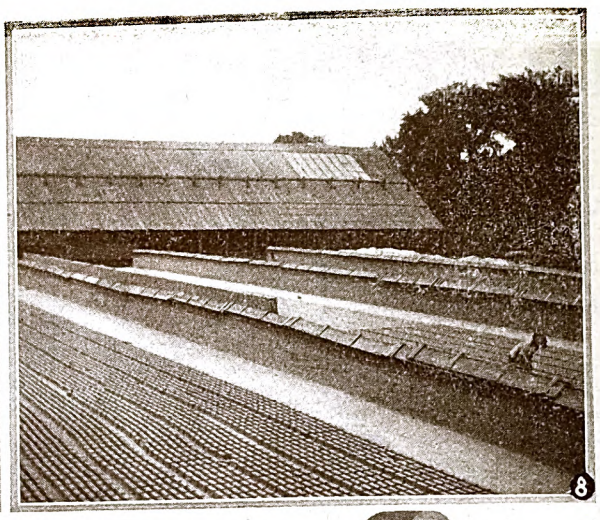


Fig. 8. The brick on the floor of the yard, after partially drying, will be "hacked" up and covered as shown until thoroughly dry.

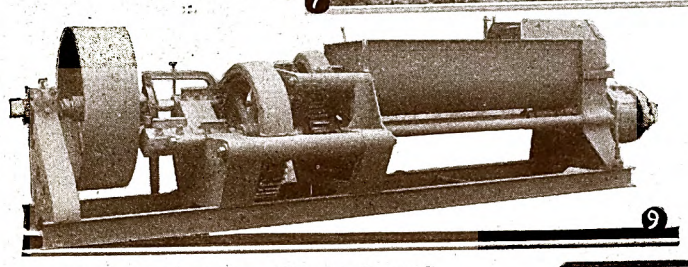


Fig. 9. A pug mill. Clay is dumped into the hopper and pushed along by the revolving knives, which thoroughly mix and knead it into condition for molding into bricks.

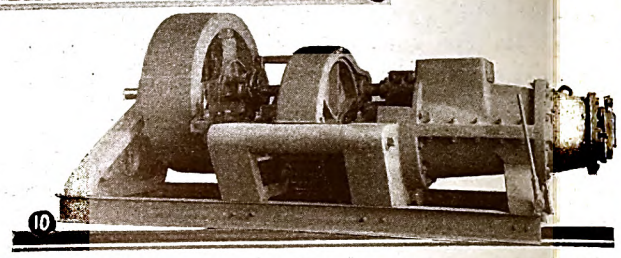


Fig. 10. An auger brick machine combined with a pug mill. This forces the clay through a die from which it emerges in a continuous column, of rectangular section, which is cut into bricks.

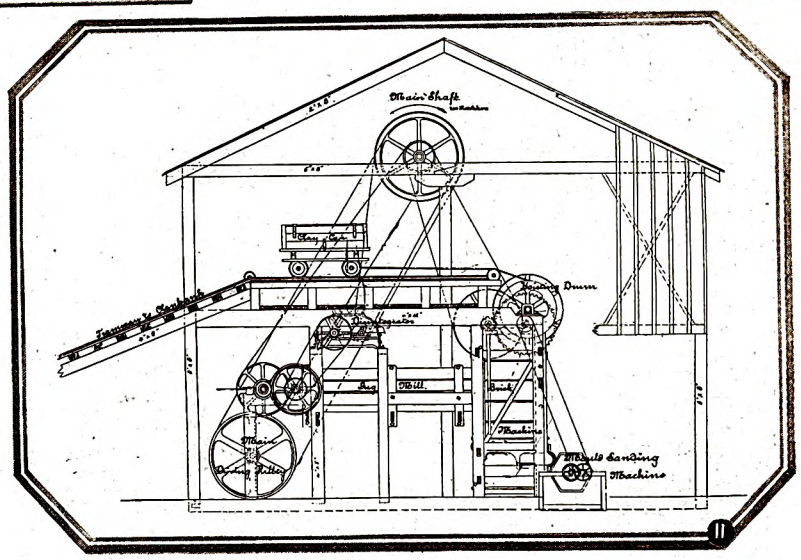


Fig. 11. General diagram of machinery in a modern brick plant.

Egypt, bricks were made by mixing wet clay with finely chopped straw, which served to bind the mass together when dried and baked in the tropical sun. Adobe buildings, still in an excellent state of preservation in Mexico and the southwestern parts of the United States, attest the permanence of this material in dry climates. The first brick buildings in this country were built of bricks imported from Holland; and the earliest date of brick manufacture here appears to be 1650, when a brick kiln was put in operation near New Haven, Conn.

Clay is a widely distributed material, but not all clays are adapted to brick making. In some localities, such as along the banks of the Hudson River and in the Hackensack and Raritan River regions in New Jersey, as well as in certain districts in the Southern States, it occurs as a uniform material of fine grain, free from pebbles and easily excavated; and when thoroughly mixed with water, readily molded into the desired form. In other places it occurs in thin layers of rather hard shale that must be crushed and pulverized before mixing with the necessary water and sand to produce a satisfactory brick.

In certain parts of the United States and Canada, where clay is not available, a very good brick is made of sand and hydrated lime, baked by steam at about 125 pounds per square inch pressure. There are reported to be about 200 plants in the United States and Canada now making these sand-lime brick. The product is dense and hard, of a whitish gray color,

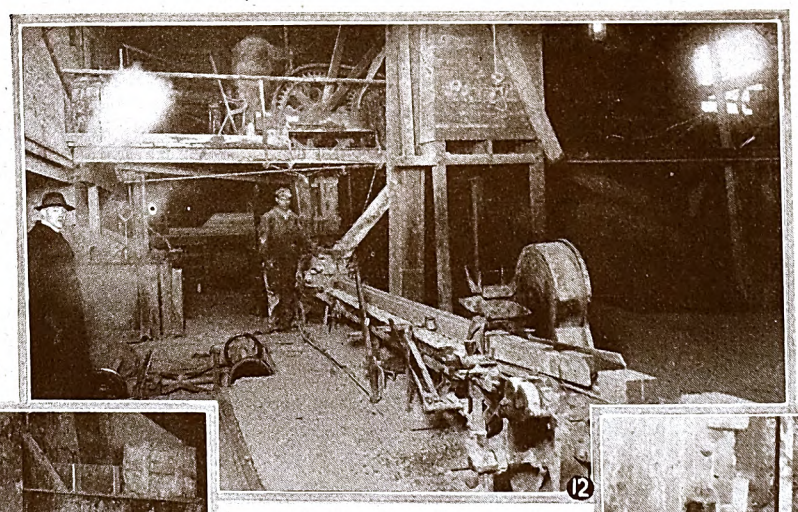


Fig. 12. Here the clay is shown issuing from the die of an auger brick machine and being cut off into bricks by a special cutting machine.

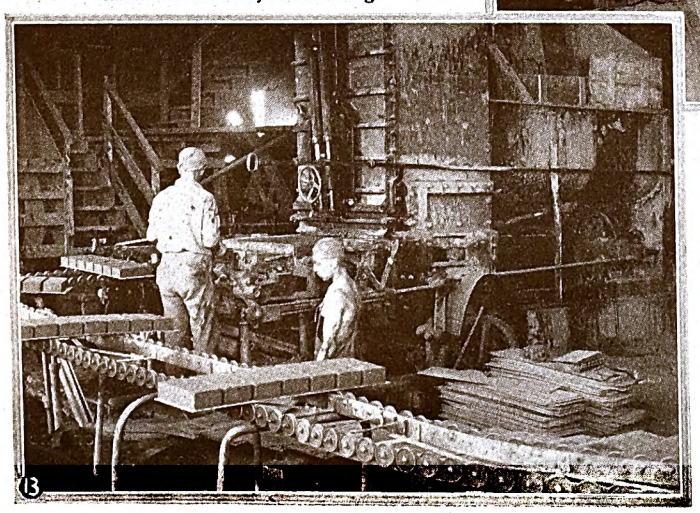


Fig. 13. One of the most modern brick machines. The man attending it inserts a steel pallet, on which seven brick are deposited simultaneously and pushed out. The pallet, with the brick on it, is then lifted off the table, placed on the conveyor, and taken to the dryer building.

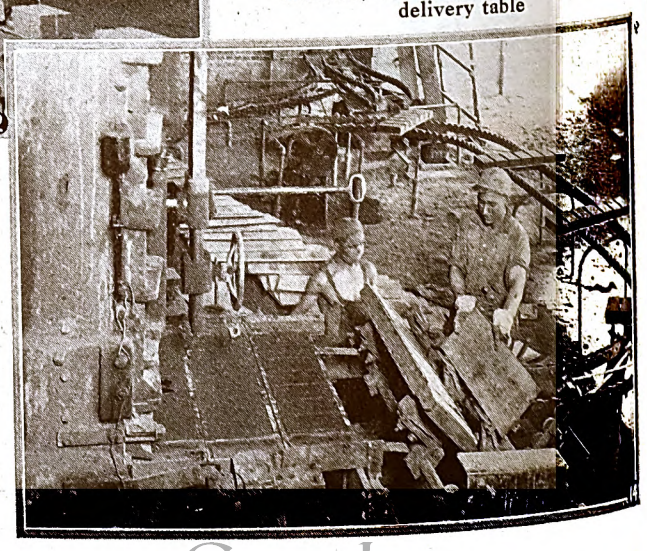


Fig. 14. Another view of the brick machine, showing a close-up of the delivery table

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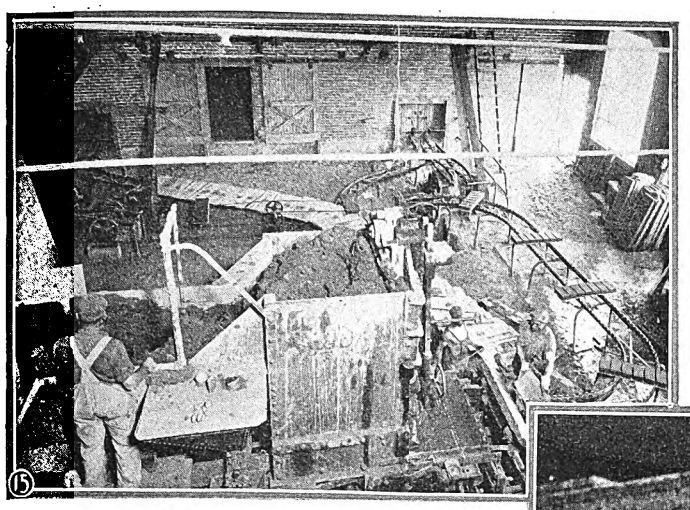


Fig. 15. Looking down upon the machine, showing the belt conveyor delivering the prepared clay to the hopper above the pug mill and brick press.

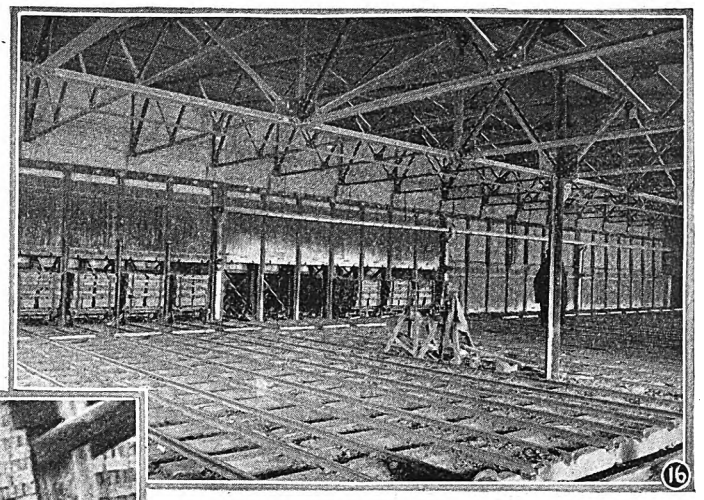


Fig. 16. Cars loaded with brick in the dryer. When the doors of the dryer are closed and steam turned into the heating coils, about one pound of water will be evaporated from each brick.

and reputed to possess good fire resisting qualities.

Brick clays are, broadly speaking, composed of silicate of alumina and oxide of iron, with a variable proportion of carbonates of lime and magnesia. The iron oxide usually runs between the limits of two and ten per cent., and is the ingredient that is the principal cause of the red color of the clay after firing.

Until recent times, brick making was carried on in a crude, uneconomical manner, using methods and appliances that had remained unimproved for years. In the North, it was strictly a seasonal business, relying very largely on hand labor, which was recruited from a floating class of workers, of all nationalities; men who applied for jobs in the spring of the year and who disappeared when the yards shut down with the coming of freezing weather. Digging clay was done by hand, and hauling by horses and mules. But improved processes and the installation of modern machinery have changed this to a very large extent.

The process of making brick is a comparatively simple one. The clay, excavated from the bank, is dumped into a pit or bin, together with a quantity of sand and some coal dust. This latter, when thoroughly mixed with the other ingredients, is necessary to insure the uniform burning of the brick in the kiln. The mixture is then soaked with water in a large pit in order to render it plastic and capable of being molded in the press of the brick machine. From the soak pit referred to, the clay goes to the machine, which presses and molds it into the form of bricks. Molds usually hold six brick, but there are many machines now in use that make nine brick to a mold. This is one part of the process wherein machinery effects so large a saving of labor, not only in molding faster, but also in pushing out and dumping the molds, thus avoiding a great deal of violent exertion on the part of the men tending the machine. With the old machines, a man was obliged to take the mold from the machine, "thump" it on the table and dump out the brick on the floor.

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Fig. 17. Old method of putting up a kiln of brick that is still widely used.

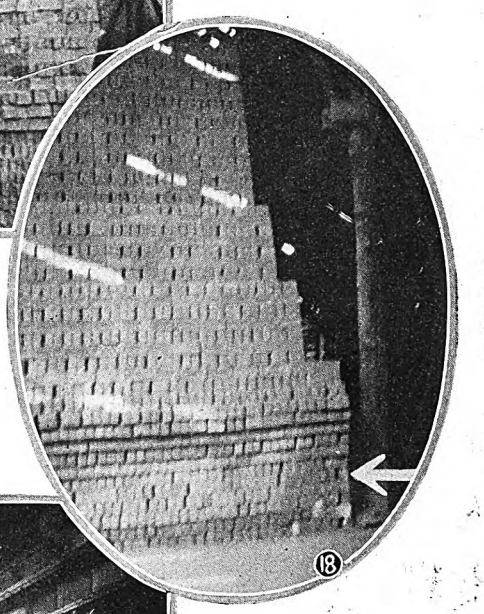


Fig. 18. A brick kiln partially taken down after firing. White arrow shows location of arch in which fire was maintained.

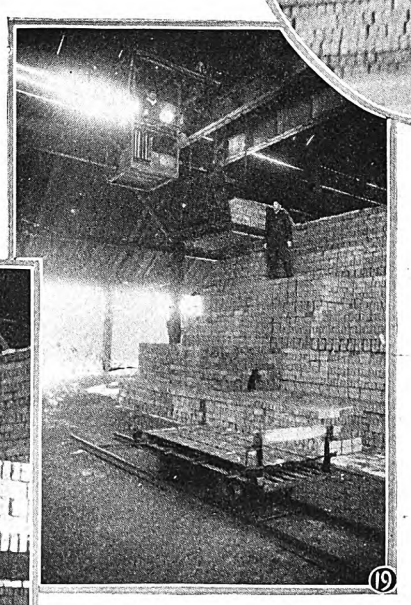


Fig. 19. Machine, operated by overhead traveling crane, which sets one thousand brick at one operation. It is easy to realize the amount of hand labor which this device replaces.



Fig. 20. A close-up of the mechanical brick setter.

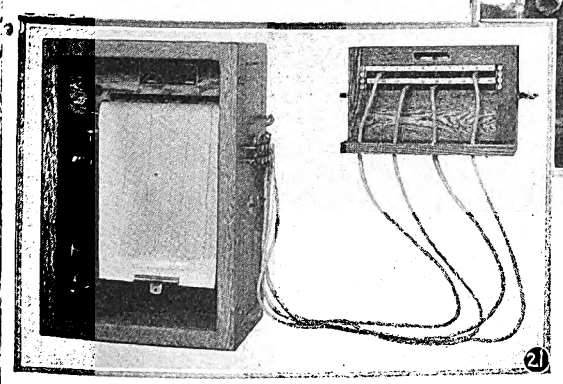


Fig. 21. Recording pyrometer connected to four separate kilns, thus showing the temperature in each kiln throughout a period of twenty-four hours.

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Making Seattle a World Port

What Harbor Facilities Mean to Industrial Growth

By P. M. Fogg

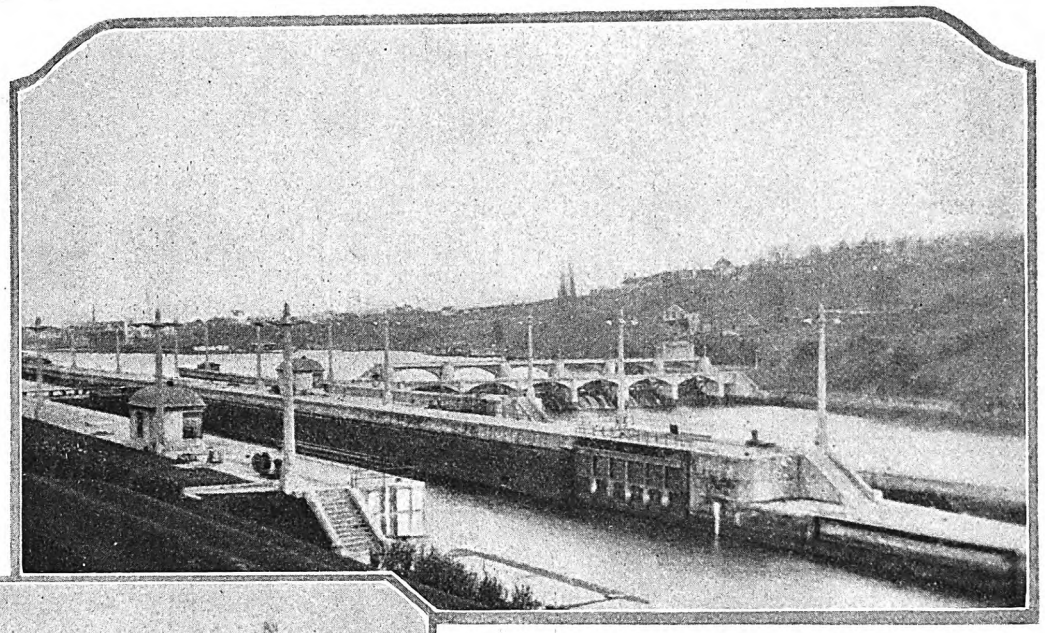


Fig. 1. Above—A general view of the Government dam and locks, Lake Washington Canal, Seattle.

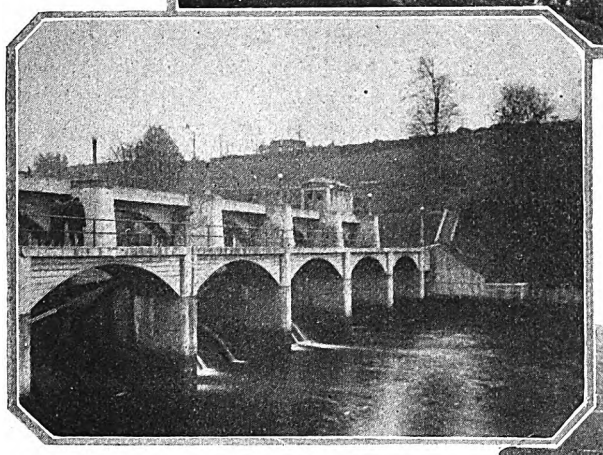


Fig. 2. The concrete dam, which maintains the level of the fresh-water lakes, Lake Union and Lake Washington.

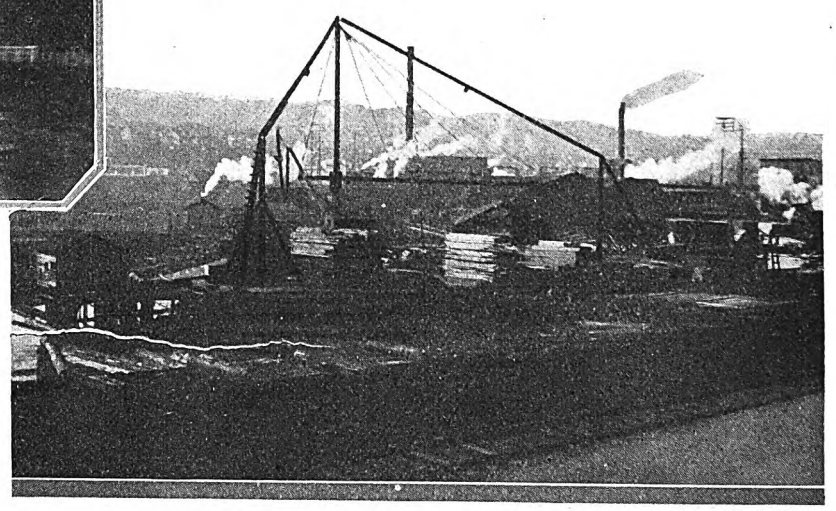


Fig. 3. At the right—One of the great lumber mills along the shore of Lake Union, whose operation was made possible by the canal project.

THE city of Seattle enjoys the benefits accruing from the use of the largest canal locks, with the single exception of those at Panama, ever built by the United States Government. At a cost of $3,570,000 these locks and the waterway in connection therewith, known as the Lake Washington Canal, were constructed a few years ago, at the expense of the Government, the State of Washington and King County, in order to open to the trade of the Pacific what is perhaps the most unique fresh water harbor to be found anywhere.

Lake Union, with a relatively small area, lies in the very center of Seattle's business and industrial district, while Lake Washington, a beautiful body of water, and very much greater in area, forms the eastern boundary of the city. Prior to the completion of the project, both of these harbor sites were inaccessible to sea going commerce.

It required the dredging and extension of Salmon Bay, a natural slough leading from Puget Sound to Lake Union, and the excavation of a short canal between the latter and Lake Washington, to supplement the lock construction and thus render available fresh water anchorage having a shore line of more than a hundred miles.

For nearly a half century before the realization of the dream

(*Continued on page 67*)

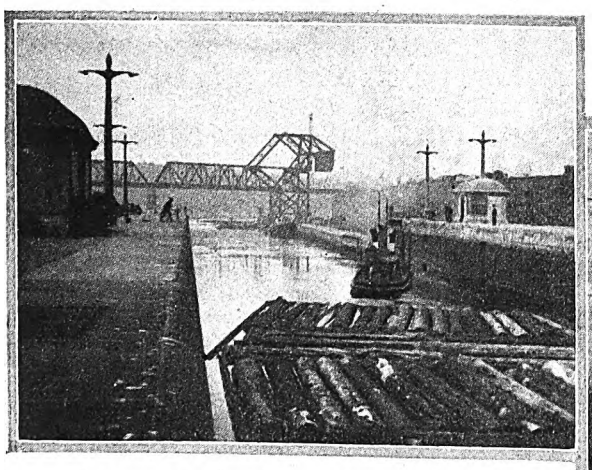
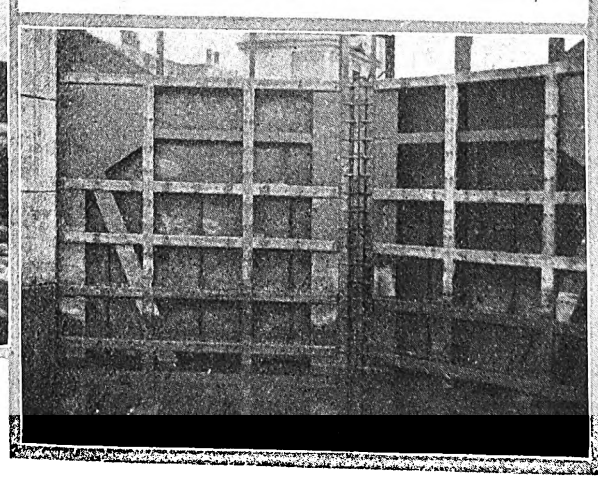


Fig. 5. A tug and raft of logs, passing through the large lock, on the way to Puget Sound.

Fig. 4. Below—A close-up of the massive steel gates in the smaller lock, Lake Washington Canal.



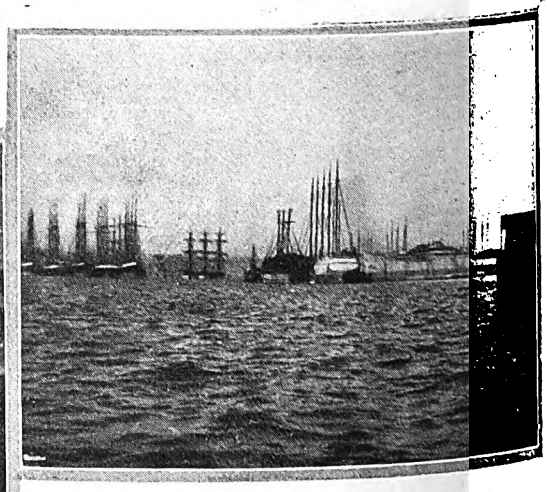
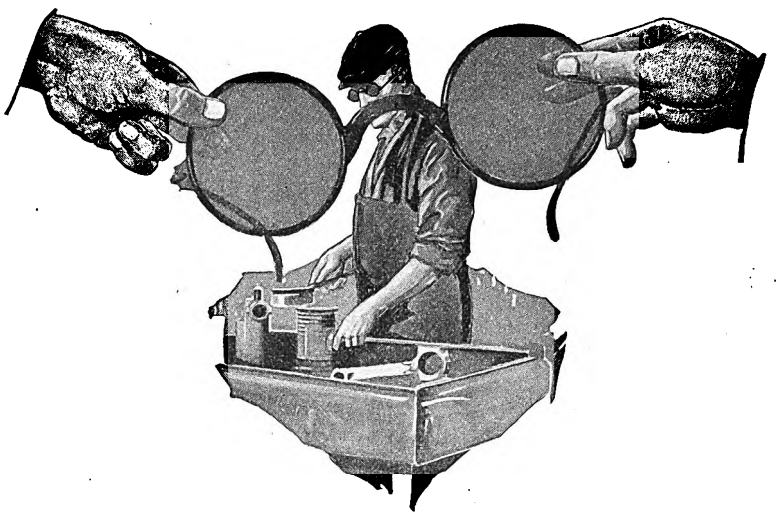


Fig. 6. Lake Union, Seattle; showing its commercial development, made possible through the canal.

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CERTAINLY not! But are you unthinkingly making as costly a mistake?

Are your workmen laboring under poor lighting conditions? Has the glass in your plant become so dirty that daylight cannot enter?

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Any ordinary laborer can clean the dirtiest glass easily, quickly and splendidly with SKYBRYTE.

He simply coats the glass with SKYBRYTE. Almost instantly this amazing cleaner loosens the most stubborn crust of rust, grease, soot, or carbon scale. Then flushed off with water the glass is clean. Daylight floods your plant. Light intensity increases five fold. Production jumps. Spoilage is rarer. Accidents are fewer. Workmen are more happy and contented. Light bills are less.

Costs But a Trifle

Five gallons of Skybryte cleans 4,000 square feet of glass. An unskilled laborer cleans 5,000 square feet per day. The average total cost of cleaning, including both labor and SKYBRYTE, is less than 3/4 cents per square foot.

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Although Skybryte is so easy to use and so quick in results it is absolutely harmless to paint, putty or sash. We guarantee this statement. And hundreds of great manufacturing plants — steel mills — foundries, etc., will gladly tell you that our statements about Skybryte are far too modest.

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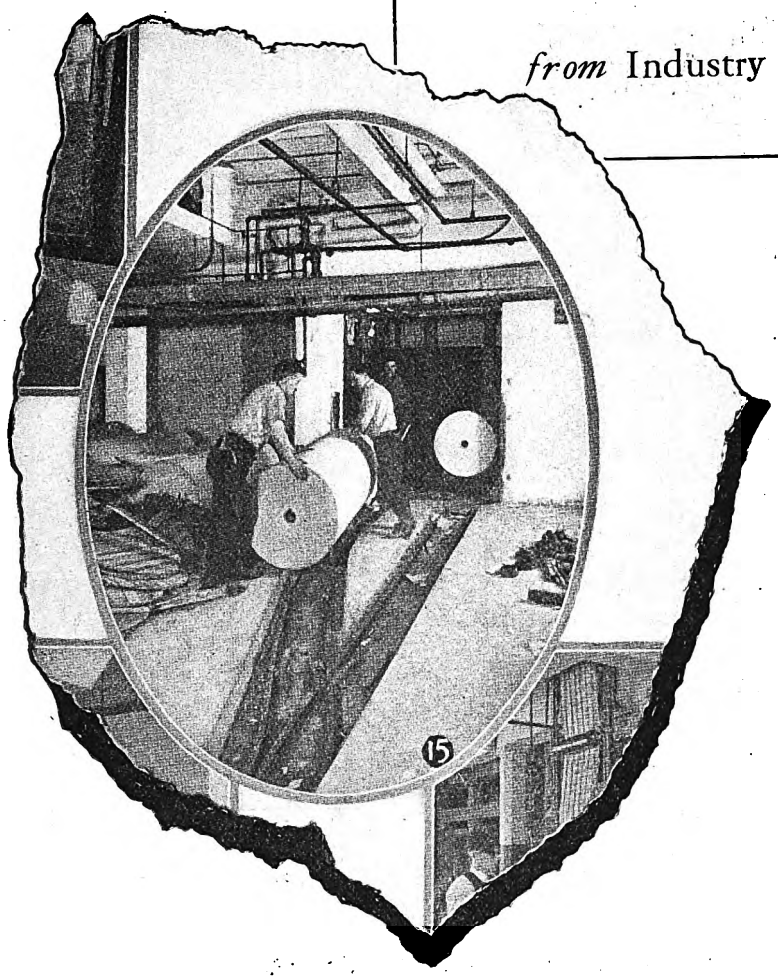
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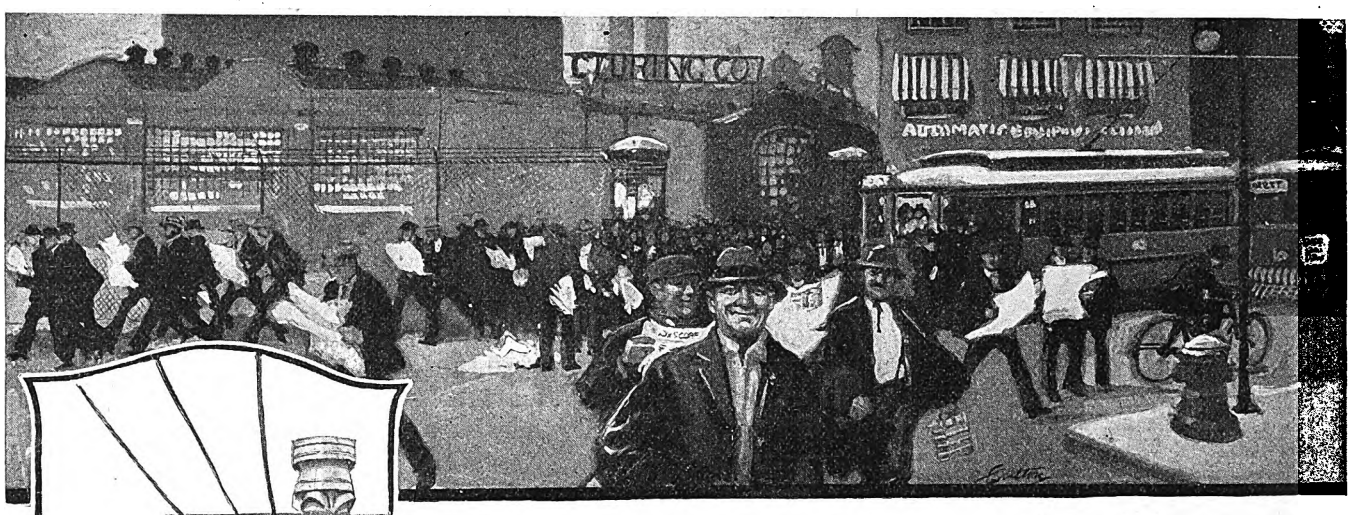
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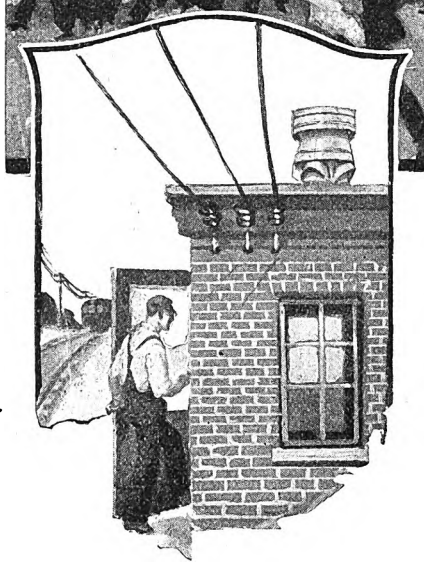
machine platform by means of a grooved stick. It is also well to equip these machines with live roller platforms, providing they are to be used exclusively on cases, otherwise they should be provided with a flat wood or steel platform, with a live roller attachment which can be easily slipped into place, and which is shown in figure 4. Figure 4 also illustrates a practical and efficient method of handling the top cases on the pile. In order to eliminate the heavy pulling, these men use pipe rollers, so as to roll one package on top of the other. It is then more or less of a trick to get these pipe rollers out from under the packages. By using a crow bar, as shown in figure 4, and placing it under the edge of the top package, with one end resting on the machine platform, it is easy to raise the entire package either for removing or placing the pipe rollers when the package is to be handled. This is one of the little practical stunts which the men easily find out for themselves after the equipment has been in operation.

Figure 5 shows how a similar machine assists in handling bulky bales of materials. It is not only the vertical lift machine that is efficient in storage work, but such equipment as shown in figures 9, 10, and 11 have also been found quite applicable, and have materially reduced piling costs.

Let us take figure 9 or 10 as an example for comparison between hand methods and machine methods of piling. We can safely assume that either conveyor would pile twenty bags high. In fact, the installation in figure 10 has already piled the bags over thirty high. If old hand methods were used, it would require an entirely different method of operation, as it would be necessary to provide space every fifth or sixth tier of bags for the men to stand on. The steps are made necessary because this is the average height to which men can lift. On each of these steps two men would have to be placed, in order to pass the bags from one level to the next. It will be readily seen that the higher the pile, the higher the cost of operation goes. Thus we find that with hand methods, to pile bags five tiers high, requires two men; to pile bags from five to ten tiers high requires four men; to pile bags from ten to fifteen tiers high requires six men, etc., increasing the gang by two men for every additional five tiers.

This means that to pile bags as shown in figure 9 or 10, if hand methods were used, it would require from eight to fifteen men, and when the piles were completed there would still be a loss of valuable space as the steps upon which the men stood while passing the bags from group to group would remain unfilled, and no hand method could possibly fill these steps. The continuous slat conveyor pilers which are shown can pile the bags from twenty to forty tiers high, and one man, or at the most, two men, is all the direct labor cost that needs to be applied against the piling operation. In addition, the machine eliminates the unused





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space over the steps, and piles the materials flush with the aisles.

In figuring the savings, in figure 9 alone, we can assume that the machine does the work with two men, making a saving of the labor cost of six men, at 50¢ per man hour. This would mean a saving of $3.00 per hour, or $24 per 8-hour day. At this rate it would not require many days' work to pay for the machine.

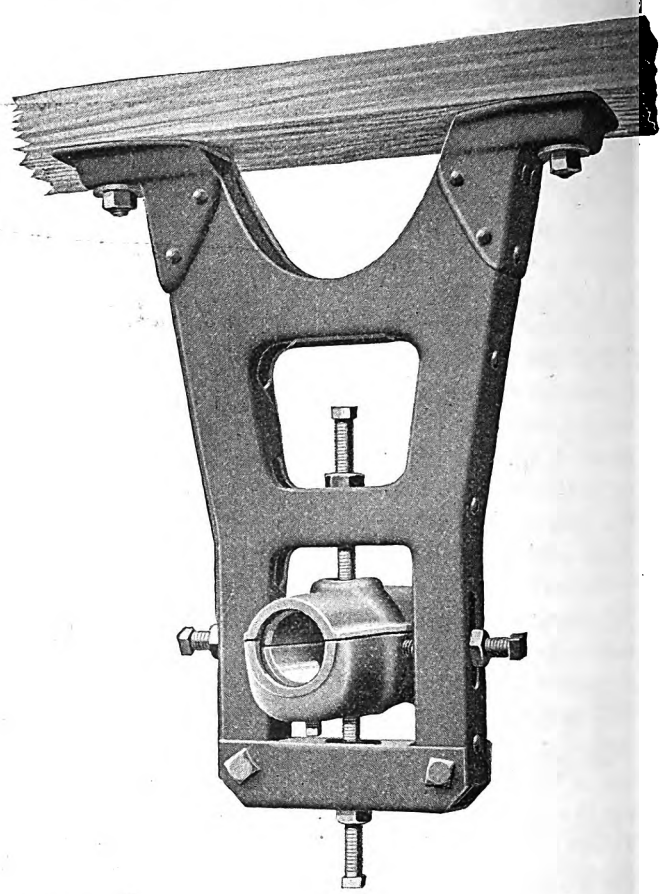
The savings as shown can be realized also in the operation of piling cases, bales, crates, etc., and the heavier the package the greater the savings because more men would be required to lift on each step.

To illustrate this point, we will look at figure 8, where bales of cotton are being piled to a height of over 25 feet, and where formerly the goods were not piled so high, and yet a labor force of over twenty men was required for piling. Now the telescoping portable elevator and three men perform the entire piling operation. In addition, the telescoping feature of the portable elevator, which is quite unique, permits the same machine to pile between the roof trusses as shown, as well as under the roof trusses, without the necessity of continually adjusting or the use of hinged sections. The change from one height of lift to another is accomplished by an ingenious arrangement of sheaves, and the telescoping of the uprights.

Many products, because of their large bulk, have made it difficult to pile, and the result has been warehouse space extravagantly wasted. This was particularly true in the tobacco industry, and the storing of hogsheads of tobacco. Their weight, as well as their bulkiness, made it very difficult to pile them more than one high. In the old method of piling, when it was desired to go two high, which was the best that could be accomplished, the practice was to put a wooden horse support under two planks, and then to lay ropes on the floor, so that two men could roll the hogshead up to the edge of the plank, and adjust the ropes around the cask. Six men on top of the first tier then pulled on the ropes, and as the hogshead moved forward up the planks, the men on the floor put blocks under it, so that it would not roll back while the other

(*Continued on page* 33)

Specify Dodge Steel Hangers for these good reasons



They are—

Light—strong—safe—easy to erect, unbreakable and low priced.

This hanger has broad feet of malleable iron securely riveted to frame which is of box form, spot welded and riveted to insure rigidity and ample strength. Capillary or ring oiling bearings can be furnished. Either type provides positive uniform lubrication with no attention aside from draining and refilling once every six months.

Dodge Pressed Steel hangers are sold from stock on the immediate delivery basis by local mill supply and machinery dealers.

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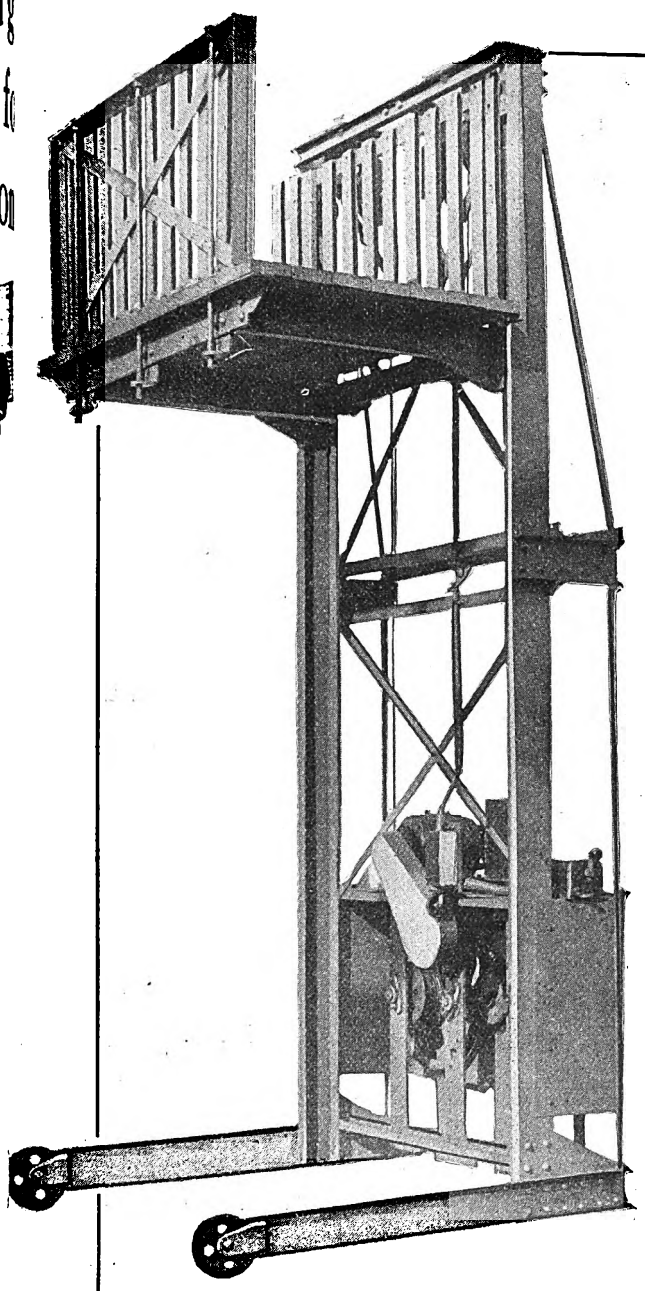
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Recent Improvements in PORTABLE ELEVATORS *that Boost Production Cut Operating Costs Reduce Maintenance Increase Safety and Make Practical their Use for Fixed Positions*

The new and other features of the Delta Portable Elevators all tend to speed up the men, give absolute safety, save the mechanic's time and the expense of repairs and adjustment. The construction and electrical control of Delta Portable Elevators are so simple that any laborer can easily understand their operation instantly.

Above—Delta Elevator, used in fixed position. With special 72" platform to handle 3000 lb. cases of French plate glass. This is a twin drum, twin rope machine. The cases are rolled on platform with a dolly, elevated to a mezzanine, automatic limit set to stop at that height. An example of one of the innumerable uses of the Delta. Illustration at the right shows a standard electric for portable use.

The outstanding improvements on Delta Portable Elevators emphasize further the following advantages:

Speed—saves the time of men standing by while load is being moved, of waiting trucks and saves car demurrage.

Safety—does not depend on mechanical adjustment or mechanical knowledge of operation. The safety features eliminate the possibilities of damaged goods, injuries to men and make the machine fool proof.

Simplicity—the Electric Delta is so simple in construction that the only cost of maintenance is an occasional lubrication.

The drive, controller, limits, motors and solenoid are fixed units, connected by fixed wiring. The only adjustment is for brake shoe wear.

Every requirement can be met by our standard line of hand power and electric portable machines. We also build machines to order for special purposes with greater speed, extra height and special platforms, sizes to meet any condition.

Write for Catalog 104

The New Features

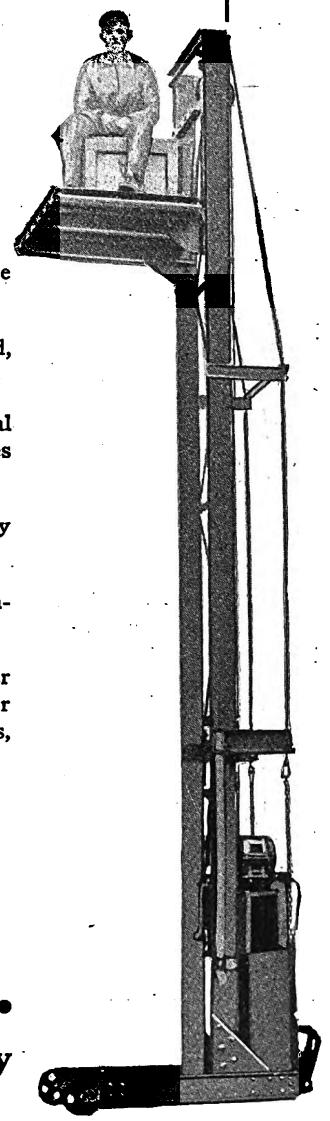
Automatic Electric Brake—locks when circuit is broken by controller, limits, low voltage or failure of current for any reason.

Automatic Electric Upper and Lower Limits—that break the motor circuit locking the brake, when platform reaches high or low position.

Reversing Type Hoist Motor—controls lowering speed.

Simple Open Arrangement of Parts and Units—no adjustments requiring mechanical knowledge.

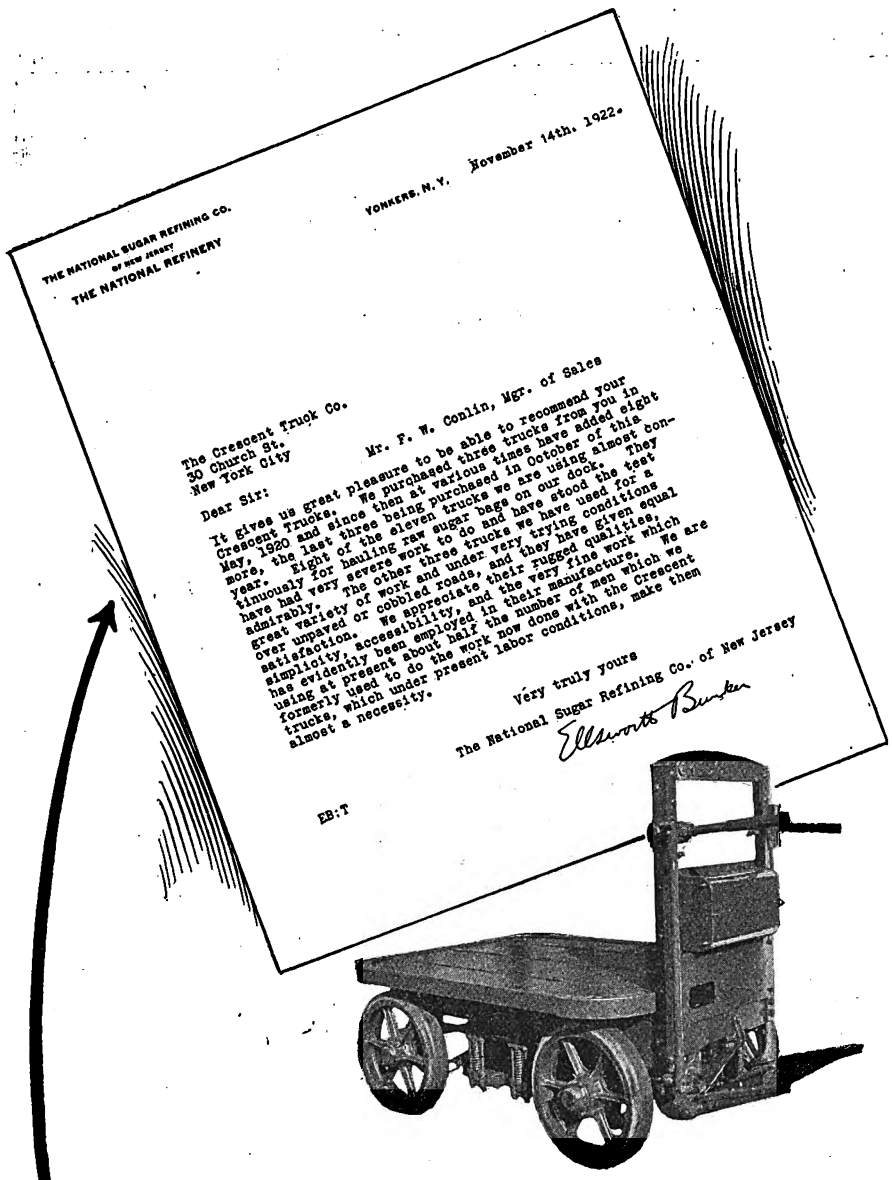
Twin Dram, Twin Rope—eliminates side tipping of extra wide platforms.



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The National Sugar Refinery ordered eight more CRESCENT trucks after the first three proved to possess every quality required of a truck.

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In practically every industry CRESCENT Trucks are justifying their original purchase and further repeat orders demonstrate their ability to stand up under every demand of severe service.

Let us send you the complete catalog, showing a truck for every requirement of industrial haulage.

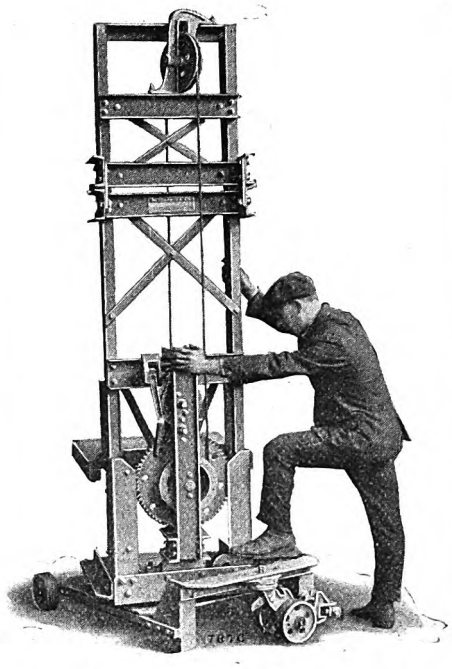
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These 12 companies are operating 356 Revolvators. An average of 29 each. One has 44, all have over 17 Revolvators.

Don't use men for work a Revolvator can do

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The Revolvator has unlimited uses. It is used to pile bales of textiles, barrels of oil, boxes and crates of merchandise, rolls of paper, etc. When one job is done the Revolvator is easily moved to the next one. Fewer men do more work in less time with the Revolvator than was ever accomplished by labor alone.

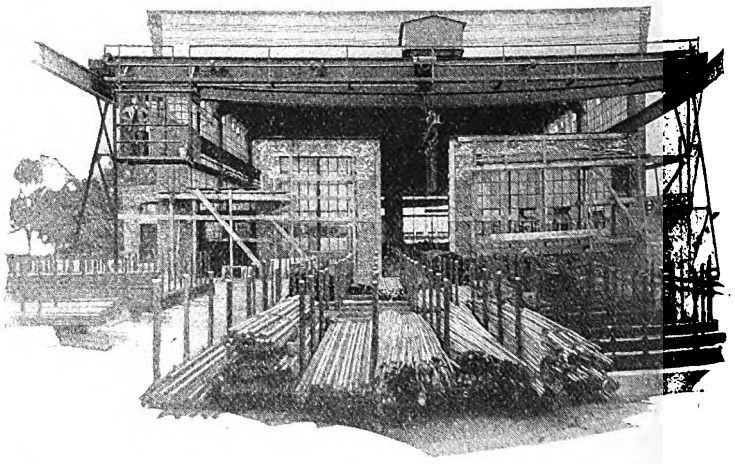
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Not only will Niles Cranes handle raw materials, billets and shapes, sand, coke, scrap, etc., cheaper and more rapidly than a gang of laborers, but materials can be stored with greater compactness, no alleyways have to be left, and the Crane will load or unload material at any point without disturbing other materials piled around it.

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Niles Electric Traveling Cranes are built in capacities up to 250 tons and larger. We also build Traveling Trolleys, Wall Cranes, Gantry and Gib Cranes. If you have a lifting problem, call our engineers in to help you.

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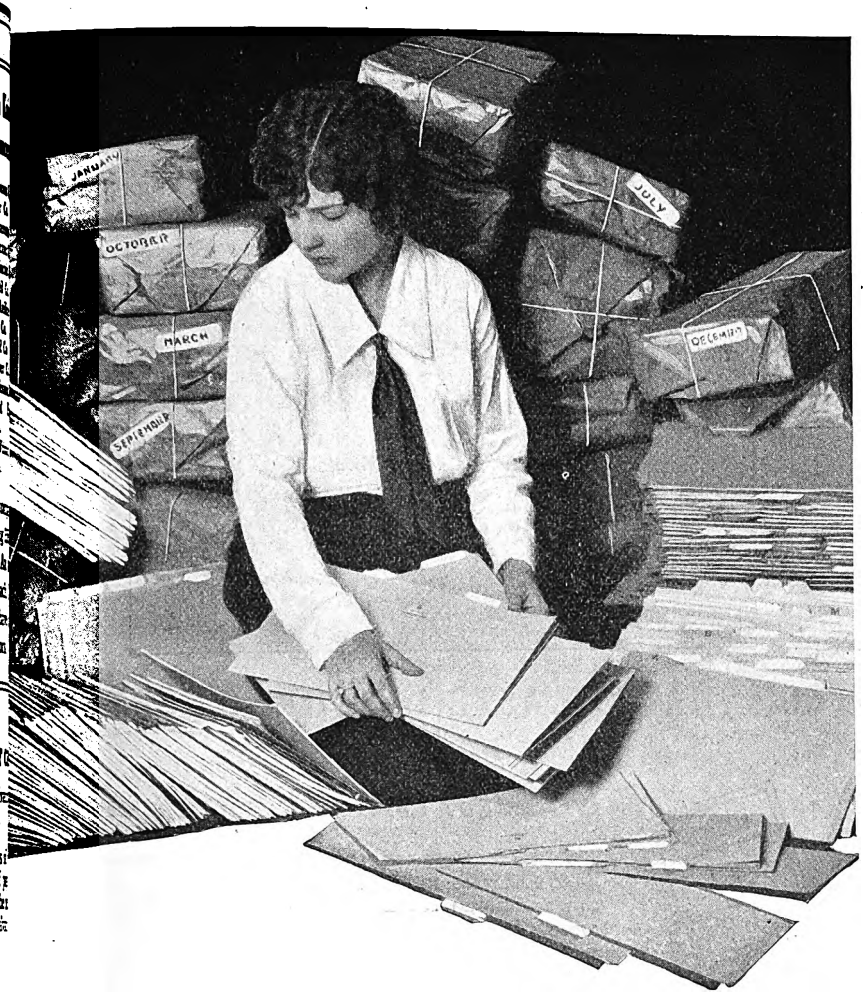
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Front office executives like to be able to push a button and have the correct papers brought to them instantly. That's fine, but those same front office executives should remember that such efficiency does not just happen.

Somebody must bring it about by hard, painstaking work, forethought *and the right kind of transfer cases.*

Van Dorn Transfer Cases are better because: (1) they're closed against dust (no open sides); (2) they save space; (3) they're strong; (4) they interlock rigidly without bolting; (5) they're easy to use; (6) they're good looking; and (7) they cost no more.

There is a grand rush for transfer cases at the last minute. Don't wait. See the Van Dorn now, place your order early and get delivery *before you need the cases.*

THE VAN DORN IRON WORKS COMPANY
Master-Craftsmanship in Steel
CLEVELAND

Branches: Cleveland New York Chicago Washington Pittsburgh Philadelphia

Van Dorn
MASTER-CRAFTSMANSHIP IN STEEL

(*Continued from page* 30)

men were getting ready to give another pull on the ropes.

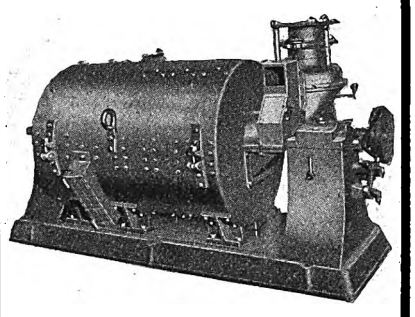
In contrast to this method, the new method shown in figure 7 is presented. Here the cask is rolled on the machine by two men, and swung into position, and by the simple pressing of a button, the hogshead can be piled two or three high, at a very slight cost.

Every industrial executive knows that the fixed cost of maintaining and operating a warehouse is the same whether every inch of space is utilized, or whether the building stands empty, and many executives have searched about to find a way of reducing this fixed cost of providing storage space which is required mainly during three or four months of the year, when the industrial centers are hard hit with snow and sleet, to such an extent that shipments are delayed. This refers not only to the provisions required for maintaining a stock of raw materials for their own manufacturing process, but frequently at the same time of the year it is necessary to provide a large space to take care of the surplus stocks of finished goods, due either to the reason that the users of their products have purchased a large stock previously, and are not therefore ordering new materials, or for other reasons which are known as seasonal conditions of certain industries.

We also find that the space in these warehouses is not utilized to the best advantage, nor has much thought been given to the construction of the building, and the storage requirements. Executives have been reluctant to pile materials high until absolutely necessary because of the high cost of placing bags, barrels, boxes, cartons, etc., higher than two men can lift. This means that in order to take care of two or three months' storage it has been the practice to maintain large warehouse space, which is frequently more than half empty for over 75 per cent. of the year. In order to overcome the large fixed cost of maintaining this idle warehouse space, some executives have dodged the issue by piling material in every conceivable corner of the plant and sometimes under very poor storage conditions, so poor that frequently valuable merchandise is spoiled before it can be used.

(*Continued on page* 35)

Pulverized Coal



The Aero Unit System

of Pulverized Coal again demonstrates, as in other work of human endeavor, how an original idea at first worked out by complicated and costly methods is finally simplified and perfected until it becomes a part of our every day existence.

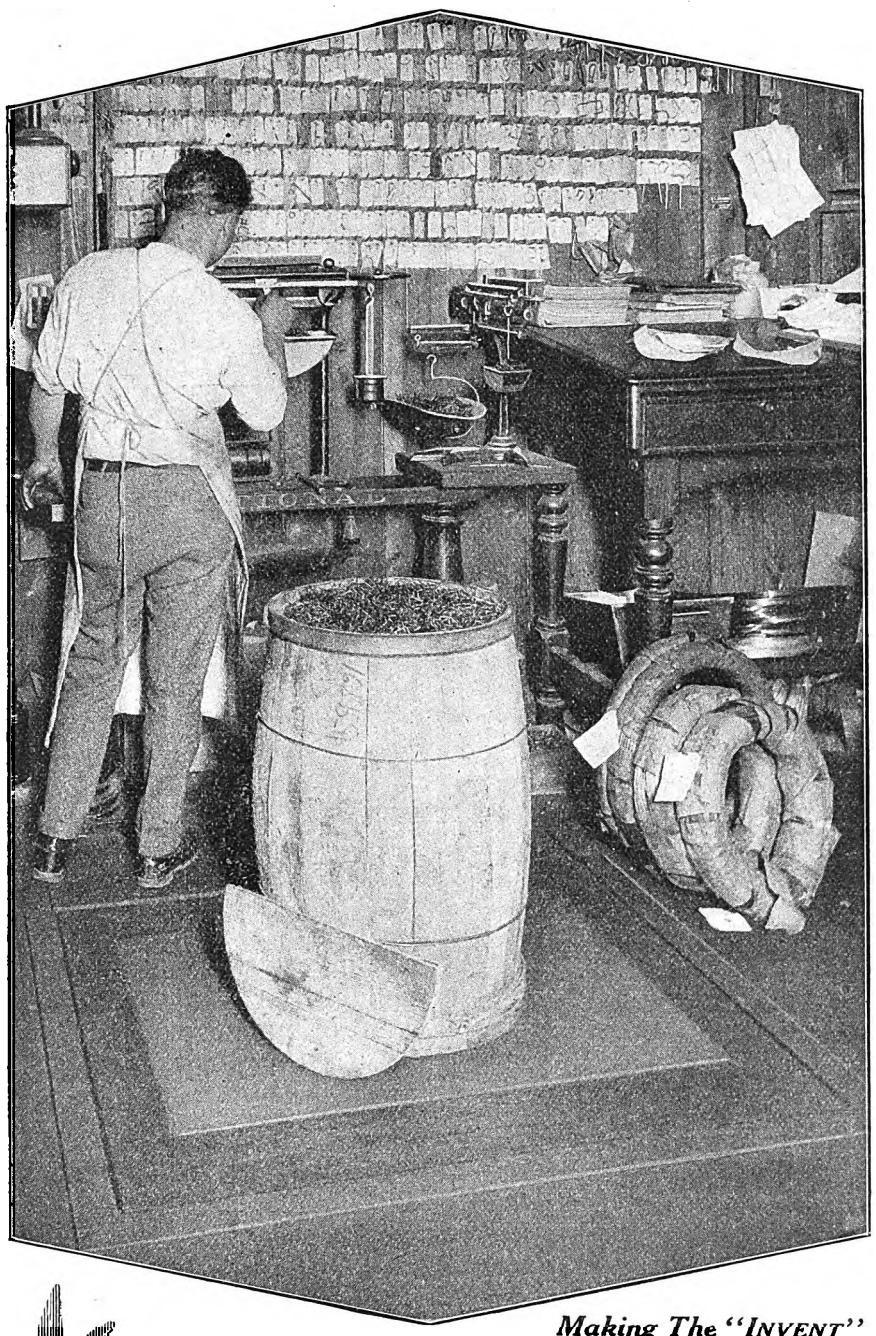
The Unit System reduces the equipment and therefore the cost to a minimum by placing the Aero Pulverizer at the furnace where the coal is fed to the machine undried and is exhausted therefrom directly into the furnace. There are no dryers, no storage or long lines of transportation for the powdered coal, thus eliminating the hazard of fire or explosion.

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Thousands of manufacturers use National Counting Machines. Let us give you the names of many who have cut Inventory time in half or better, using fewer workers than formerly required.

You get Facts—Not Guesswork, when you put National Counting Machines to work in daily service or on Inventory.

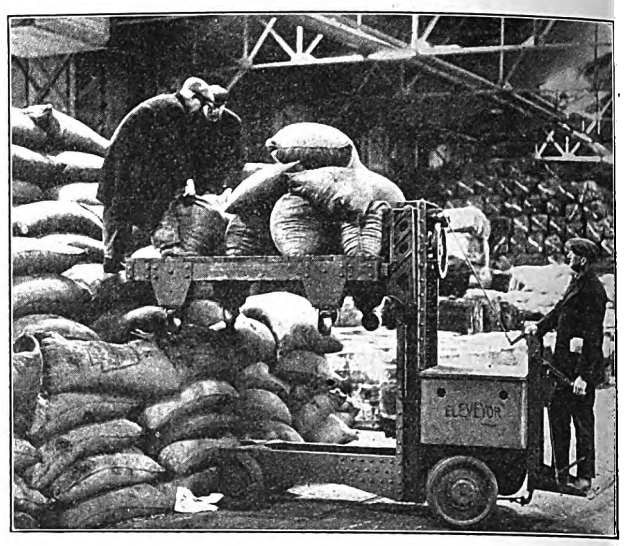
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The ELEVEYOR is the Truck that conveys materials anywhere in the plant, elevates and stacks.

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Zering Live Platforms Cut Costs

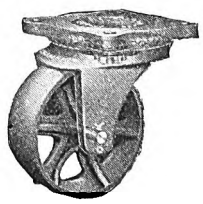
Zering Live Platforms move easily upon ball bearing swivel casters. They economically handle the heaviest loads and make lift trucks unnecessary for short hauls.

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Manufacturers of trucks, trailers, casters and skids

When you grow sick and tired of truck breakdowns due to having purchased casters "on price" and not quality, ask us for Bulletin 18.

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(*Continued from page* 33)

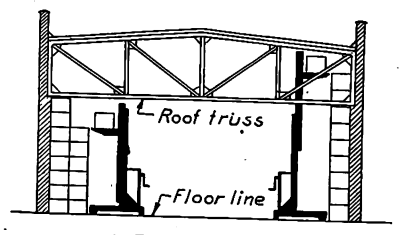
It will, therefore, be seen that a makeshift solution of the problem is not the real solution, but a definite layout should be made and the necessary building space provided to protect all merchandise that is being held in storage. It is true that it is often cheaper to have a large floor space than it is to hire additional manual labor to pile higher than six feet, but the expensive waste of floor space is no longer necessary because of the large number of materials handling machines and devices that have been put on the market to eliminate the laborious work and the high cost of piling materials.

This equipment consists of portable elevators, conveyors, special racks, overhead cranes, monorails, etc., the use of which permits the piling of materials to maximum heights and in addition has cut the cost of piling from 50 to 80 per cent. over manual labor costs, and the difference in money saved and the fixed cost of maintaining idle floor space goes into profits instead of on the debit side of the ledger account.

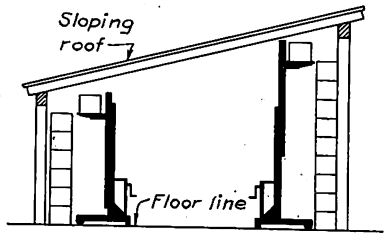
Mention was just made that thought should be given to the storage layout, and figures 13, 14, and 15 show why this thought should be given, particularly in the storage of barrels. Figure 13 shows the method of storing sugar at the Savannah Sugar Refining Company, Savannah, Ga., and the barrels are piled six high, with what is known as long dunnage between each tier. This form of storage is permissible when large stocks of similar products are to be handled, and when all the materials in the barrels are dry, but to stand barrels on the limb, as shown, would be impractical if liquids were to be stored, because of the excessive leakage which would occur due to the heavy weights of the upper tiers. It is, therefore, necessary in storing liquids, to lay the barrels on the bilge, as shown in figure 14, and to provide dunnage between each tier. Figure 14 is the interior of an oil warehouse, and the building was designed particularly for the storage of this product. Hand labor was employed for raising the second tier of barrels into position, and the storage requirements called for considerable floor space because of the many grades and kinds of oil to be stored. For this reason we find some barrels stored two high, while others are tiered one high. This means a considerable waste of overhead space, as shown, and also high labor costs for piling the second tier of barrels. In addition, the weight of the second tier frequently created enough pressure on the staves of the first tier of barrels to cause leakage, thus making it necessary to break down the pile in order to save the contents of leaking barrels. This meant additional expense whenever it was necessary to rehandle the barrels.

The cost of maintaining such warehouses became so acute that it was necessary to find a better method of storing oil in barrels, and upon investigation it was found that steel racks were being manufactured particularly for the storage of barrels, and that portable elevators were also successfully operating in raising the barrels any desired height, in order to fit them into, or remove them from, these racks.

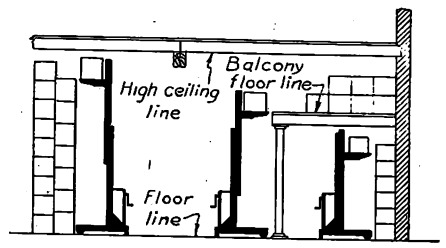
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1. Between Trusses

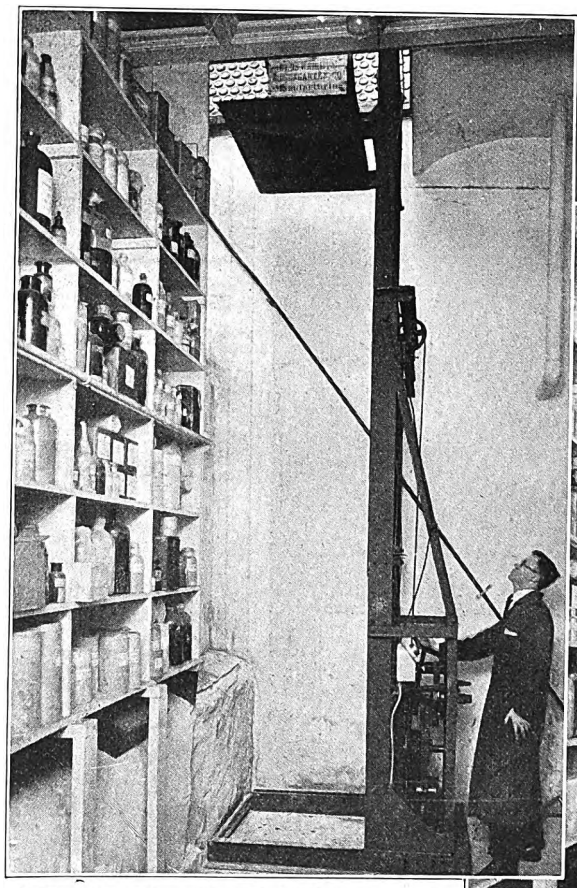


2. Under Sloping Roofs

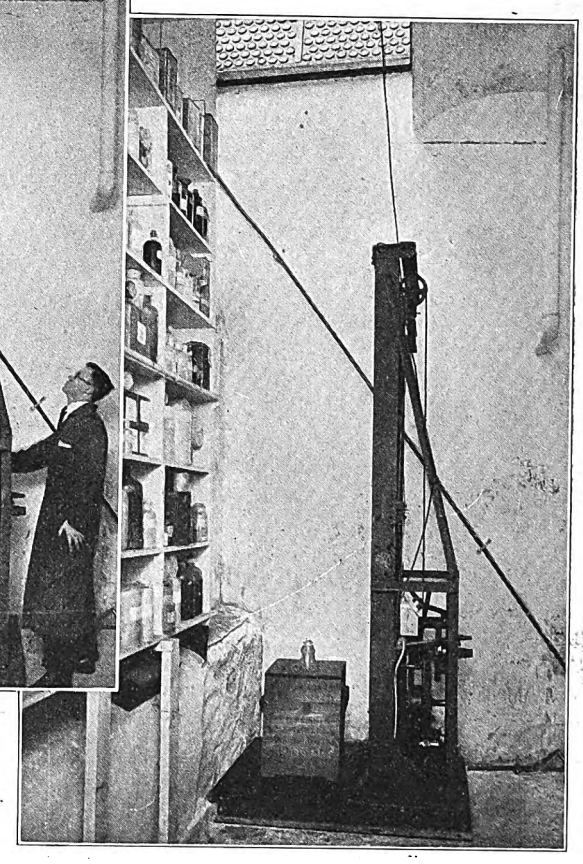


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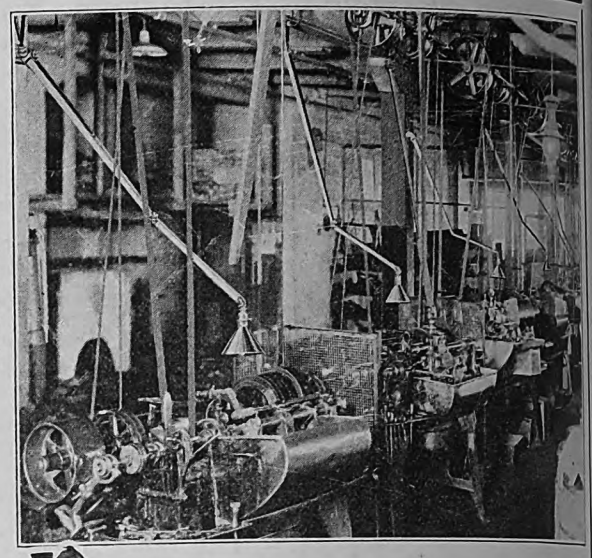


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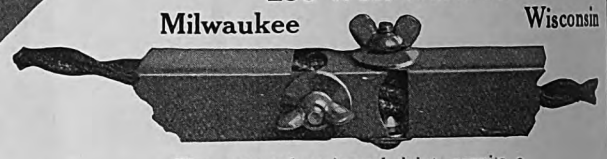
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SALES OFFICE & SHOWROOM GRAND CENTRAL TERMINAL NEW YORK CITY

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(*Continued from page* 35)

The racks had these advantages over the old system,

1. Of providing more storage, by utilizing the overhead space,
2. The reducing of labor costs,
3. The racks were so designed that each tier was separate and the first or bottom tier could be removed without disturbing the second or third tier, and vice versa, and thus there was no pressure on any tier because of other material resting upon it.

This small feature greatly reduced the number of leakers, and the loss of oil through such leakage.

It is desired to bring up a particular point here, as we are trying to show the advantages of a full knowledge of all of the present types of materials handling equipment that can be purchased, and which are considered practically as standard equipment.

It was necessary, after the rack system was found satisfactory, to put the racks in the building shown in figure 14, and while ample overhead storage space had been provided for the old method of storage, it was found that only a few inches were lacking under the center beam, which made it impossible for the racks to be built so as to store barrels four high. In other words, if the rack system had been contemplated in the first place, by making the building a few inches higher, it would have been possible to increase the storage space thirty-three and a third per cent.

To show the possibilities of economical storage, the writer at one time made an analysis of a warehouse layout, where it was necessary to provide a maximum storage requirement for 6,000 barrels of 100 different products. Ninety per cent. of the products were packed in dry form, and ten per cent. of the products were packed in liquid or paste form. All of the products were packed and stored in barrels 26″ bilge diameter, 24″ high, and 23″ chimb diameter. In order to save space, three methods of barrel storage were considered. First, the storage on the chimb, which means the standing of the barrels on end, figure 13; second, the storage of barrels on the bilge, as shown in figure 14, and, third, the storage in steel racks as shown in figure 15. The rack system proved without a doubt the best method of storage, as it allowed systematic stock keeping by groups or classes, and the separate tiers made allotting of stocks simple, convenient and inexpensive, each tier being separate and accessible, and the barrels being held free from those above and below.

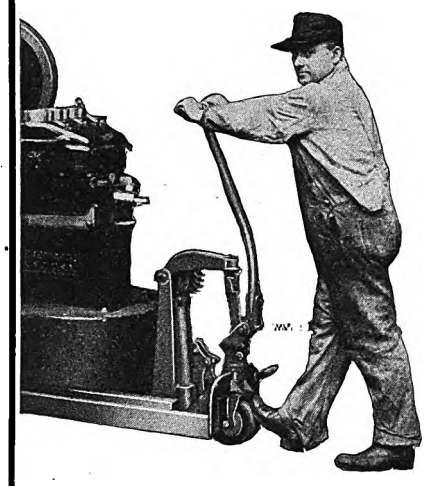
With the rack system it was possible to take a complete physical inventory at any time, as all barrels were easily reached by leaving a foot between each set of racks. Another advantage is the ability to utilize overhead space. The use of racks made it possible to tier ten high, or to a height of over twenty feet. The economical advantage of the rack system was the small labor force required to operate the warehouse. It was possible for two men with a portable elevator to place and remove all of the barrels in the stock room. Dry and liquid products were treated alike, so that their storage location in the building was interchangeable, which greatly simplified the operations.



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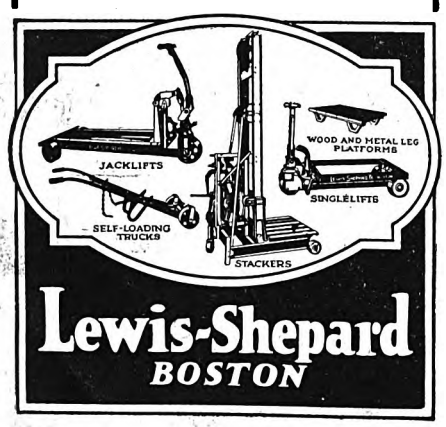
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The following tabulation shows the floor space required in this analysis for each method of storage:

Method of Storage	*Floor Area for Storage Alone, Sq. Ft.*
On the Bilge, with dunnage (4 high)	16,375 square ft.
On the Chimb, with dunnage (4 high)	13,650 square ft.
In steel racks (10 high)	7,150 square ft.

Note: The height of piling is that recommended for safe operation.

This shows that for a given area, more barrels can be stored per square foot by the rack system than with any other method. The more area required for storage, the more main aisle, incoming and outgoing aisle space will have to be added.

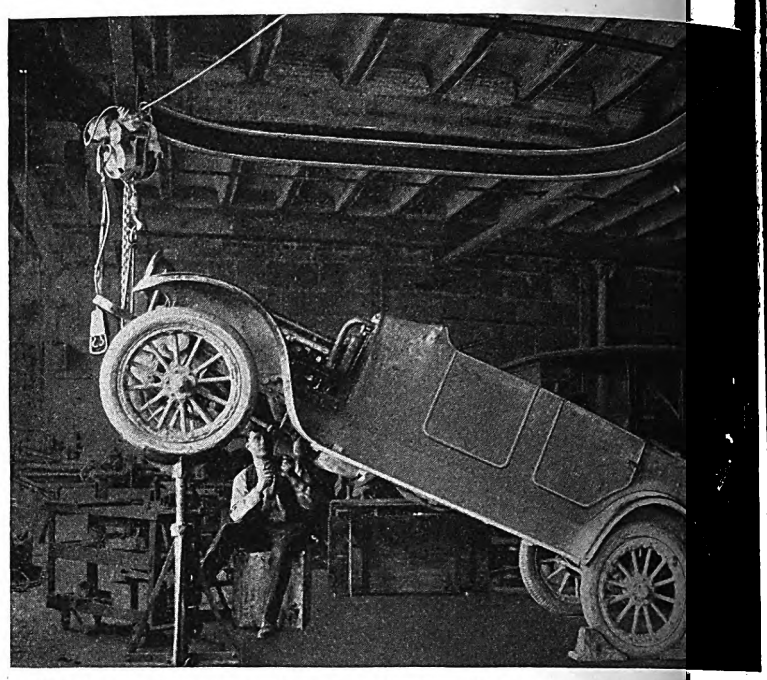
After this analysis was made, it was found that it would be cheaper to provide the steel racks in a high building, than it would be to use up valuable land space, and provide a low building, and use either one of the other methods of storage. The increased height of the building to provide for the racks was only ten feet, and as the building required for storage was only 150x60 feet, it will be seen that the cost for the additional height, plus the cost of the racks, was considerably smaller than would have been the cost of a larger building (300 by 120 feet) regardless of the cost of the land.

It is not always necessary to have the building in place before erecting the racks, and frequently by placing the racks first, a much cheaper building can be provided. Figure 16 shows how one company that was pressed for space purchased the steel racks and erected them in the yard, permitting the barrels to remain in the weather until the building plans and building permits could be obtained and the building erected. The efficiency of storing in the racks was realized immediately, and cut costs long before the building was completed.

Another instance of where materials handling equipment saved money, time and space, was in the problem of storing heavy motor wheel castings, weighing 700 pounds each. These castings were stored in the building shown in figure 17, and were piled only one high, the overhead space being wasted. The wheel manufacturer considered piling more than one high, so as to utilize the overhead space, but the

(*Continued on page* 42)

MOTORBLOC
THE *MOTOR-DRIVEN* CHAIN HOIST



View in a modern garage, showing mechanic working underneath front end of a car on a bearing job. NOTE CONVENIENCE due to the use of MOTORBLOC.



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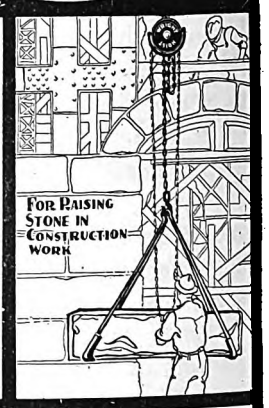
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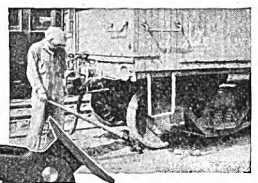


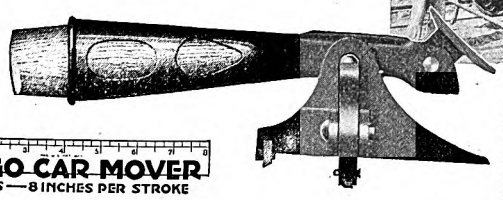
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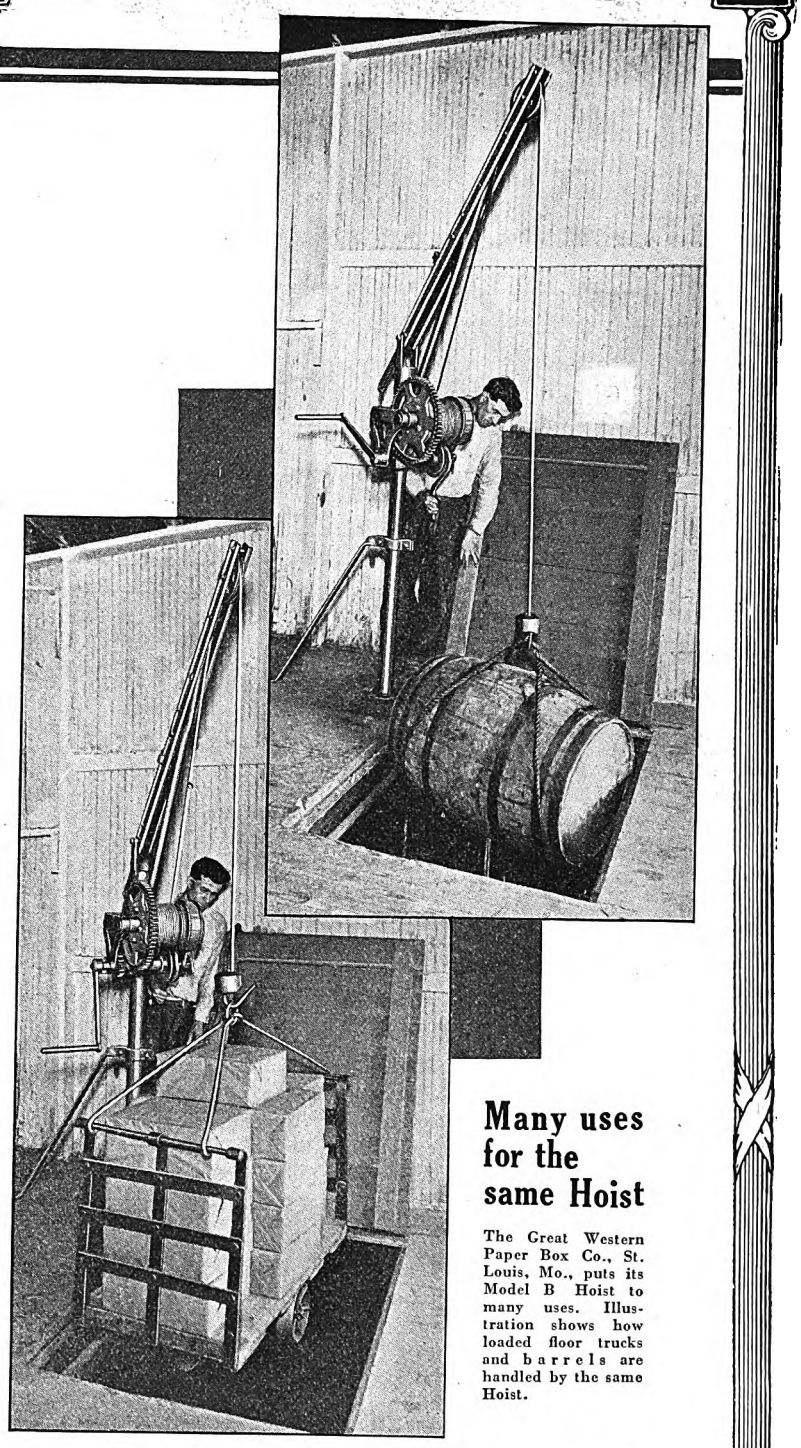
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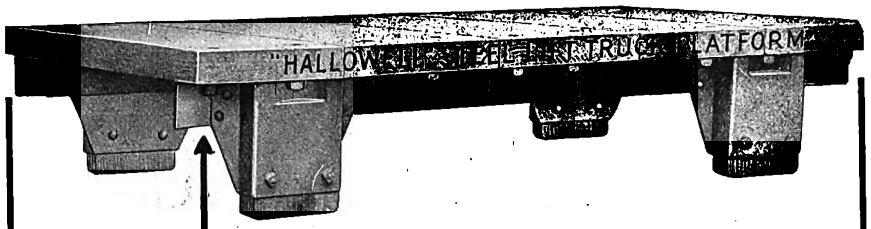
556 West Broadway New York City

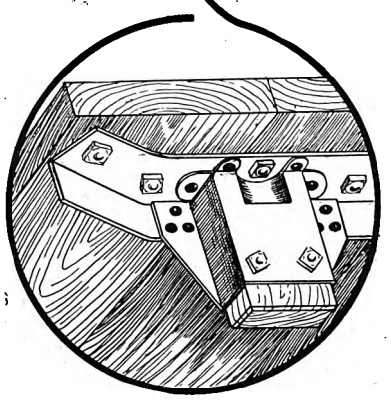
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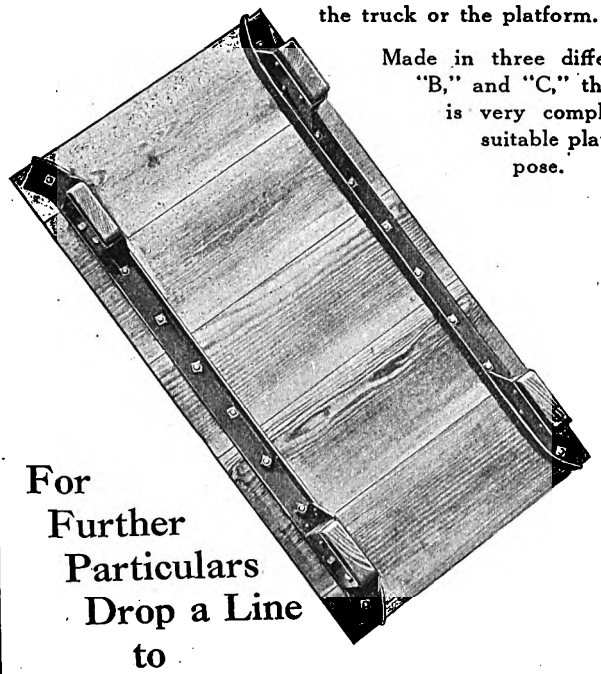
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Because it's here that proper construction will show. Because it's here—where the leg supports are attached to the runners—that hard wear brings out inferiorities. Here's where a good part of the stress and strain falls; and it's here that we have incorporated one of the strongest constructions possible in making platforms.

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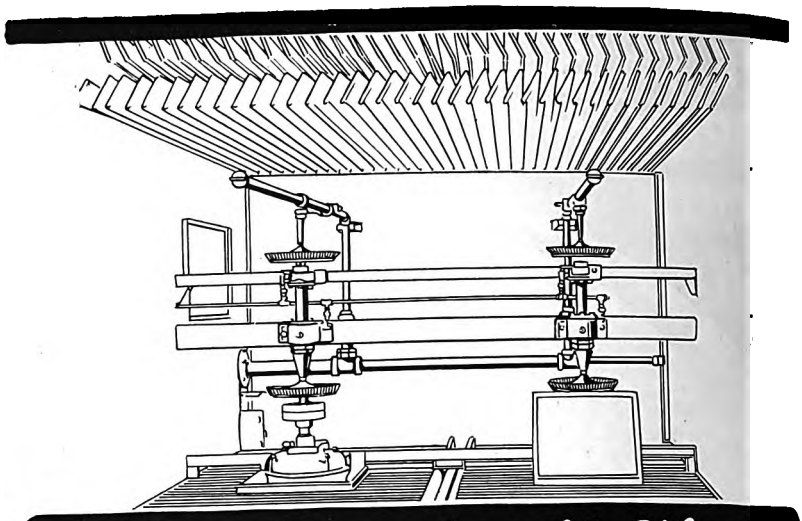
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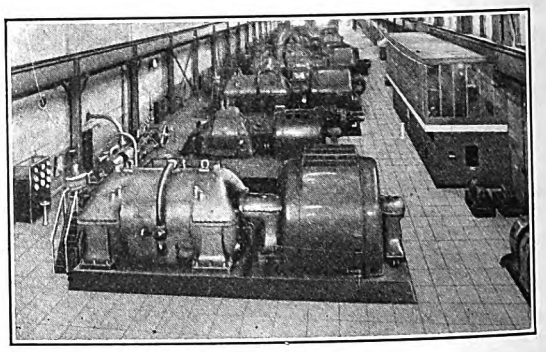
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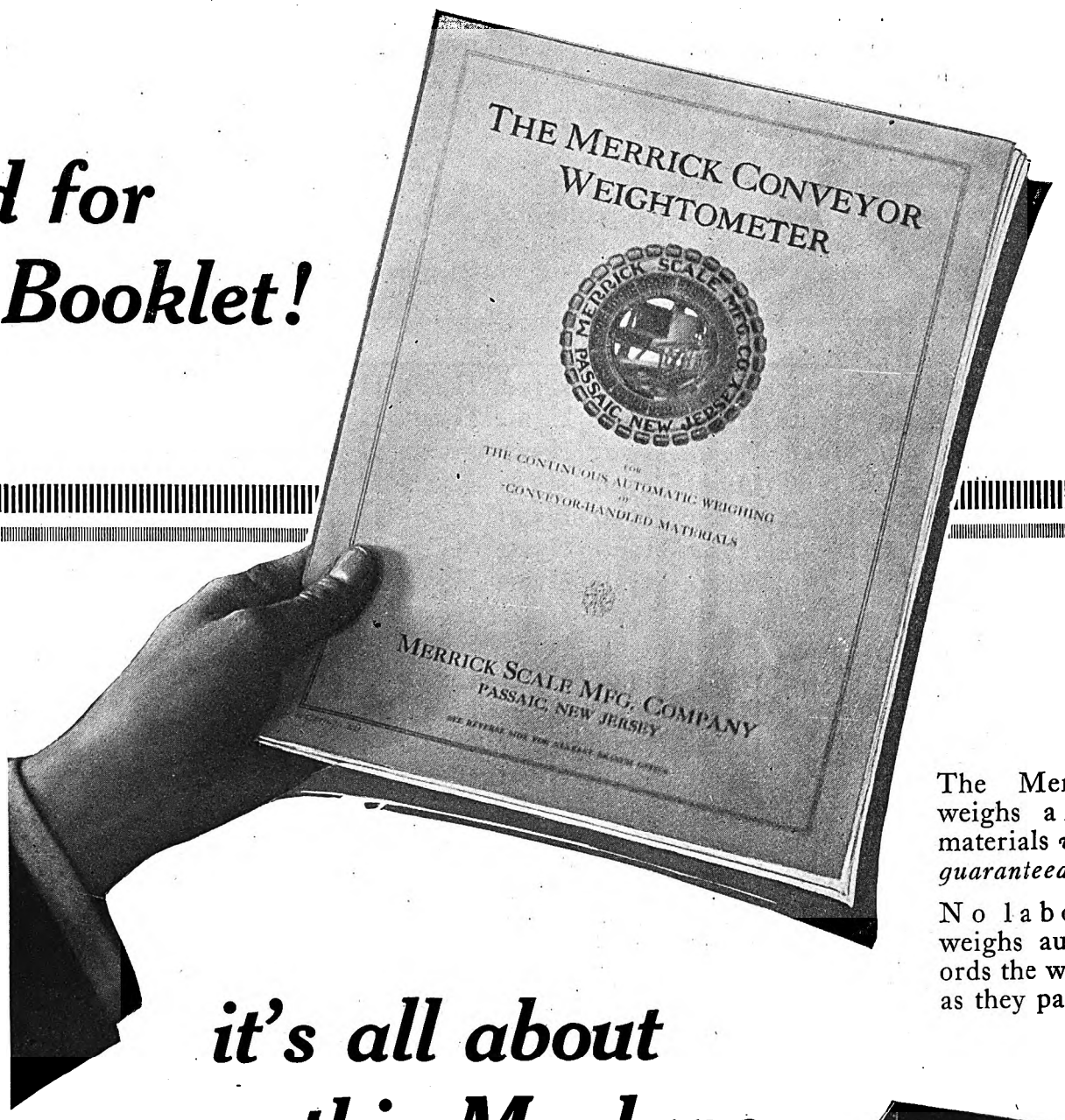
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No labor is required, as it weighs automatically and records the weight of the materials as they pass through.

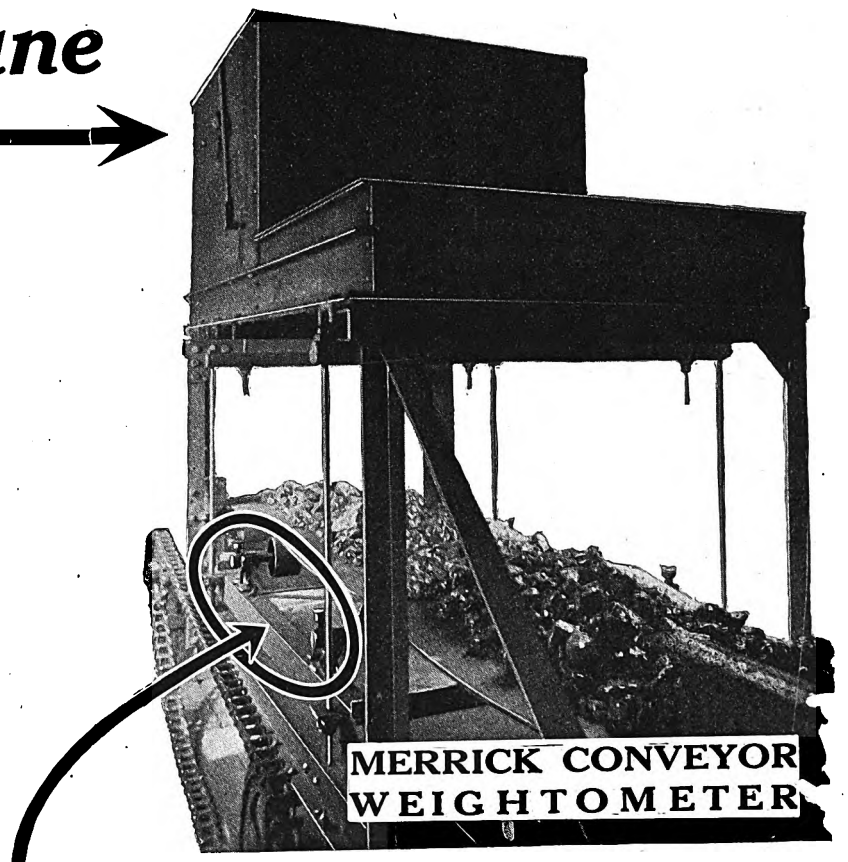
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(*Continued from page* 38)

labor expense of piling the castings was so high that it offset the value of the space above the first tier. Eventually, lack of floor space necessitated the piling of the castings, and in order to do the work quickly and cheaply, it was necessary to obtain a piece of equipment to perform the operation of piling. The complete result and the new equipment is shown in figure 17. The results are a saving of floor space, increase by 200 per cent. in storage capacity for each foot of floor space, easy and economical piling (note that the placing of the second and third tiers was only slightly more expensive than the placing of the first tier) and a much more compact storage layout, thus eliminating a considerable amount of foot travel and trucking.

Frequently the same products have to be handled with different methods, due to their size and weight. For example, figure 12 shows the best method of piling long sheet metal; namely, electric hoist with slings attached to trolley monorails, operating over the piles. At the same time, figure 20 shows the best method of handling short sheet metal with a special finger electric storage battery truck, which picks up each pile and raises it or lowers it as desired.

Occasionally special machines have to be provided to take care of particular requirements, and figures 18 and 19 show such an installation in the paper storage warehouse of the Detroit "News." The paper is brought in on small dolleys running on industrial tracks and piled as shown in figure 18. A close up of the four-poster portable elevator is shown in figure 19.

While there has been waste in the raw material and finished product warehouses, there has also been waste of time and valuable overhead space in process departments and process stock rooms, and frequently a rearrangement of the storage of materials in process will save considerable valuable manufacturing space, and will also save time and money by reducing the idle time of production equipment, and the labor expense of handling materials in process. Figures 22 and 23 show the condition before and after the rearrangement of storing stampings in process in one department of the Seng Company, Chicago, where most of the material between machine operations is stored and handled in tote boxes. The tote boxes are made of steel and mounted on wheels, and contain steel stampings, of which there are possibly twenty different varieties. Figure 22 shows the condition which existed only a few years ago. The storing of the tote boxes with this method occupied considerable valuable manufacturing space, and there was always the difficulty in getting at a particular tote box when it was required. Often the confusion resulted in the loss of many man hours, and also in the loss of many production hours, by causing idle process equipment. It also kept the three men shown in the illustration continually busy, as it was frequently found necessary to shift eight or ten tote boxes in order to get at the one desired.

This condition presented a very serious problem to the executive, but it seemed impossible to overcome it with any ordinary methods, because there was no way to pile the boxes one on top of the other, and the

(*Continued on page* 45)

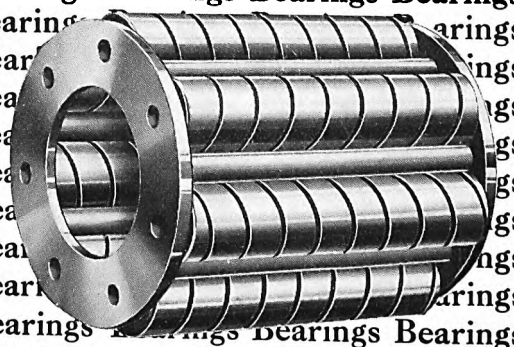
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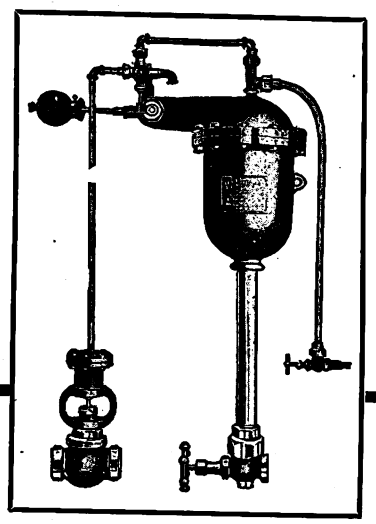
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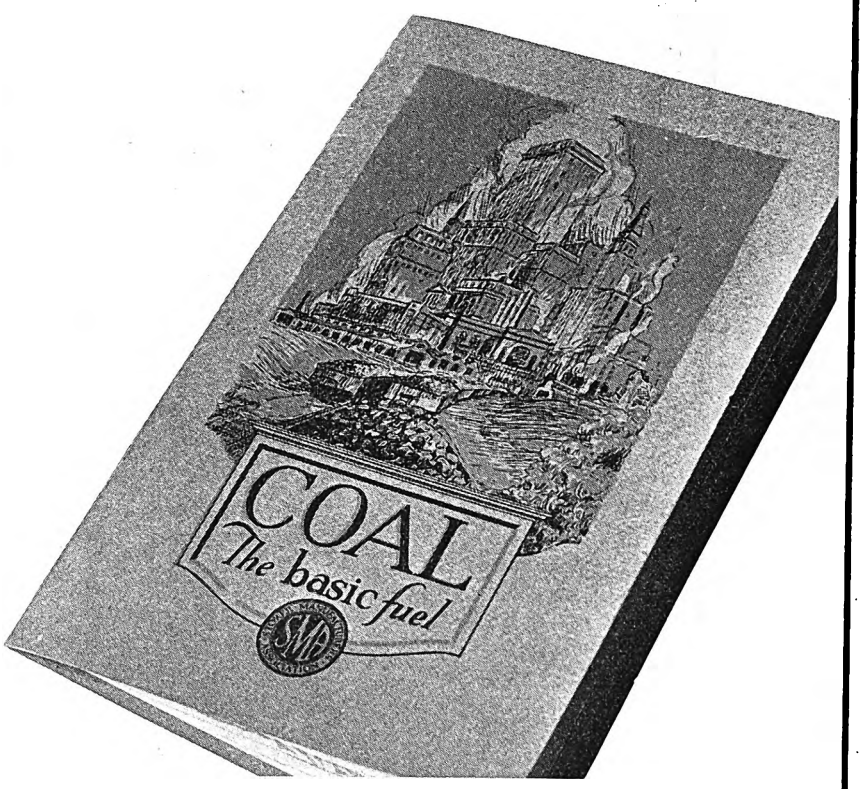
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You may think there are other "Steel-Bound" Platforms besides the one originated—and made *only*—by Stuebing.

For there are other platforms that somewhat resemble "Steel-Bound"—*in appearance!*

But you'll find, if you look closely, that none of these is made by Stuebing. And unless it's a Stuebing it isn't "Steel-Bound"!

It may have an oak top "just like the 'Steel-Bound'" and still be vastly inferior. For there are many grades of oak, you know.

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For nobody other than Stuebing can build a "Steel-Bound" Platform the way the genuine "Steel-Bound" is built!

Stuebing tested every possible method of assembly, and the distinctive manner in which the top, legs and side rails are assembled in the "Steel-Bound" Platform was perfected by years of exhaustive, gruelling tests.

"Steel-Bound" construction is the *one best way* to build a lift truck platform—and it's covered by Stuebing patents!

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If you feel, as do the nation's leading industries—such as General Motors, Goodyear, New York Central — that "Steel-Bound" Platforms are just as essential to your lift truck equipment as Stuebing Lift Trucks, you will be sure to look for this Stuebing label (illustrated above).

For you can always be sure that *unless it's a Stuebing it isn't "Steel-Bound"!*

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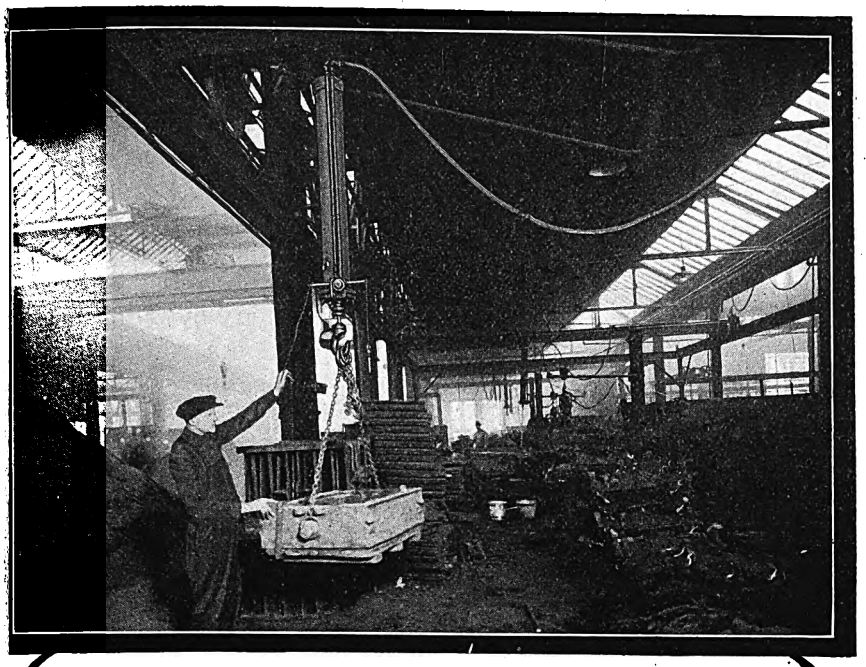
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(*Continued from page 42*)

variety of the stampings only complicated matters. This condition had existed for many months, and much thought was given to the possibility of reducing the handling expense in this department, also to increase production by reducing the total hours of idle equipment. The final solution is shown in figure 23, which illustrates the sets of steel racks for the tote boxes, and also shows the portable elevator which is used to elevate the tote boxes into the racks. The construction of the racks is simple, consisting of angle iron panels with channel iron tracks, spaced to fit the wheels on the tote boxes. The head room in the space allotted for the storing of these materials was high enough to permit tiering the tote boxes four high, as shown, and the racks were built short (five boxes in depth), which was determined to be the right amount of storage space for each assortment. A space was allowed between each set of racks to permit the man in charge of the installation to get at any particular tote box when wanted, and also to make a complete physical inventory when required.

The result of this installation was a reduction in the space required for storage to one-fourth of that required previous to the rack installation. In addition, one man now takes care of the entire storage instead of three, thus making a saving in wages of two men. Tote boxes can now be taken from one operation, held for the length of time required, and immediately delivered to the next operation without any delay to production equipment, and at a moment's notice.

It is not only in the machine industries that better storage conditions and rack methods can be employed, but, as shown in figure 24, even in the textile industry economies have been effected, in the cost of handling goods by installing modern methods of storage. This shows the warp beam storage racks on the Monument Mills, at Housatonic Falls, Mass., which have overcome the difficulty of storing warp beams in process. It formerly required four or five men to handle these large warp beams, and it was impossible to pile them more than two high, and even under the best conditions there was frequently a large item of expense, due to damaged materials, where one

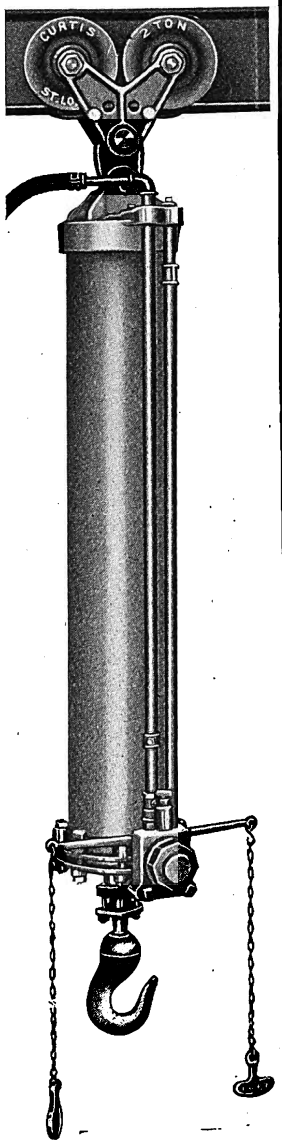


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EVEN if your plant is equipped with the most modern production machinery, there is still a big chance for you to lose money ***between*** machining operations!....Why? Simply because you may not be ***moving*** your material with dispatch, or economy (i. e. low labor cost).

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Hang up your soap with a soap-holder

and you'll hang up a new record for low soap consumption.

To any user of our soap we will supply the fixtures free of charge as long as you use our soap, and we keep them in condition.

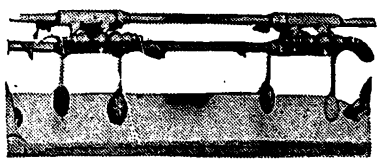
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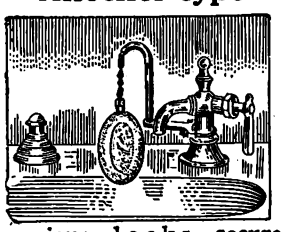
With the soap-holder—Soap cannot be carried away, thrown on floor, or left in water to become soft, mushy and unfit for use—it cannot break up when worn and clog drain or make the washstand untidy.

One of many types



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spool would come in contact with the warp on another spool, and the possibility of dirt injuring the warp also presented a serious problem and a considerable loss. Now one man, as shown in the illustration, can handle the warp beams alone, lifting them into place in the rack by the use of an electric portable elevator, which operates off an ordinary lighting circuit. In the racks no spool comes in contact with another, and they are all conveniently spaced, thus it is impossible for one spool to damage the warp on another, and the savings made by reducing the damaged goods has greatly assisted in paying for the installation of the racks. In addition, better operating conditions exist, and considerable space has been saved in the storing of goods, and time and money have been saved in the handling of the spools in storage, and also there has been a saving in idle production equipment, as it is much easier with this system to deliver goods out of storage quickly when required.

While the majority of the illustrations have shown interior storage space, we must not overlook the possibility of increasing the storage capacity of the plant yard, and figure 25 shows how a crane, equipped with an electric magnet, has reduced labor costs and increased storage capacity by piling scrapped metal higher than could possibly be done cheaply by hand labor.

Each illustration of proper and improper methods of storage will probably bring to the mind of some executives the seriousness of his problem, and they are presented with the intention of pointing out to these executives the possible sources of financial and production losses resulting in their plants, which are due to inefficient storage methods that can easily be remedied by rearrangement, more up-to-date methods, or the possible use of mechanical equipment for piling.

A number of industrial plants are now faced with a serious storage problem because it is usually at this time of the year that maximum storage requirements are called for. Now, therefore, is the opportune time to install better methods, and to realize the many benefits that can be derived in this manner.

The subject of materials handling has been more or less limited to the elevating and conveying of materials, and most executives feel that when the subject of materials handling is spoken of, it refers to the use of bucket elevators and screw conveyors. This narrowing down of the subject has greatly limited their viewpoint. The writer here states his definition of what materials handling means to him, and if the plant executives will consider the matter in this broad way, they will quickly realize that they are vitally interested in all of its phases and ramifications.

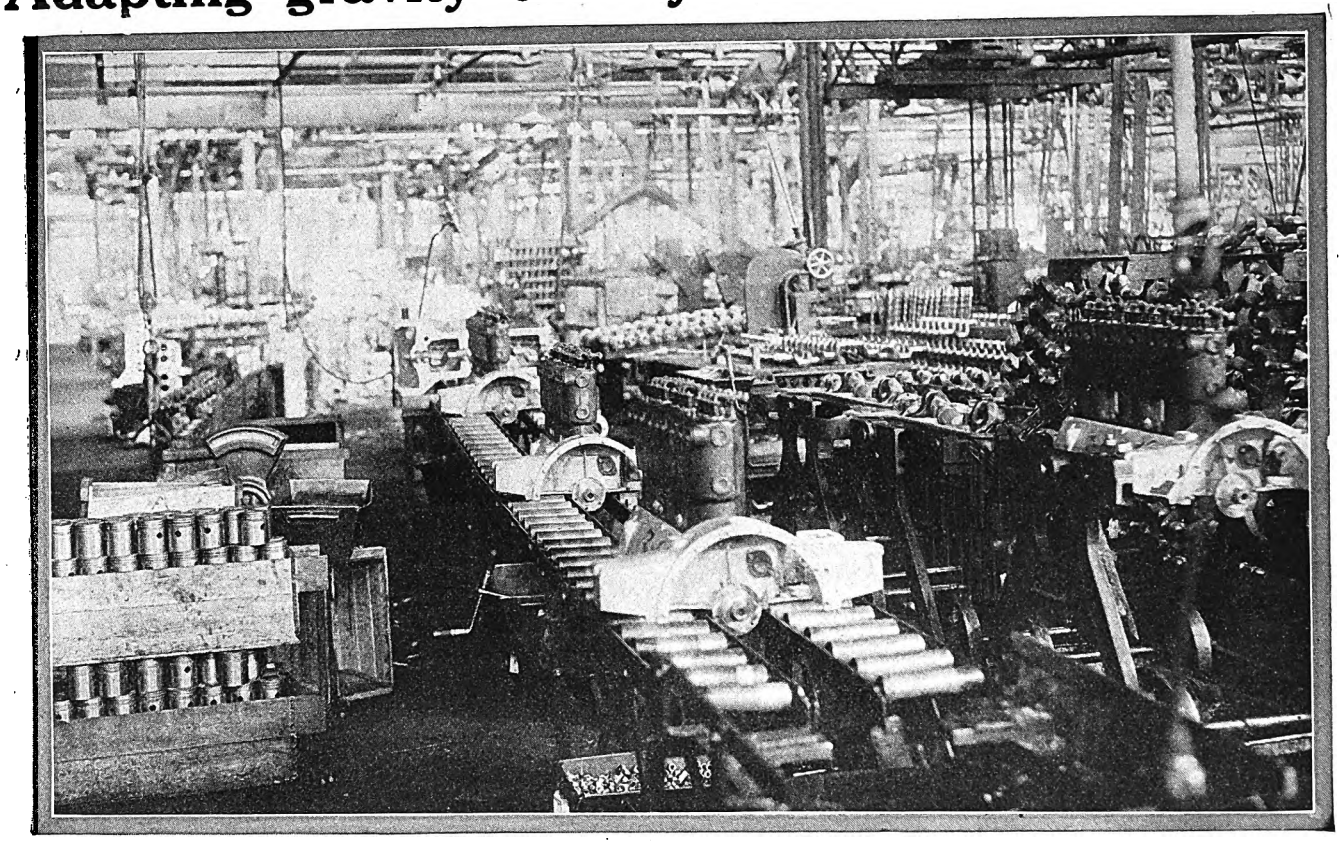
The definition may be written thus:

"Materials Handling is the Science and Art of Conveying, Elevating, Hauling, Storing, Transporting and Handling Materials from one location to another."

There are few industries in the country which do not have to handle materials into and out of the plants. Industrial executives, accordingly, should not turn their backs on the subject, as many of them unquestionably

(Continued on page 49)

Adapting gravity conveyers to machine shops



Simpler handling increased production here—and costs nothing

THIS Mathews conveyer has proved an easier and quicker way to assemble the parts used in the construction of automobile engines, crank cases, etc. Motors-in-process ride conveniently from start to finish on smooth rollers and gravity carries them free—no cost for power and no cumbersome or slow handling.

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Further economy lies in the fact that Mathews equipment is built to last. Many conveyers have been saving for their users over a period of from ten to sixteen years *without a cent for repairs.*

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Our engineers will gladly consult you on your handling problems. There may be one or many places in your plant or shop where Mathews conveying equipment can reclaim many hours of labor and speed up production for a fraction of the present cost. Our entire experience is yours for the asking, or, a catalog of facts will be sent upon request. Write us today.

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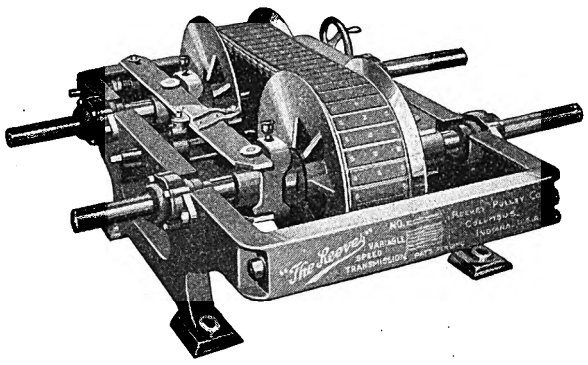
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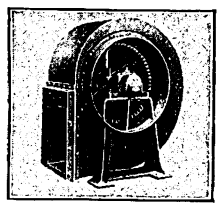
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At least one of the fan and blower applications described here often many have a profitable application in *any* plant.

The principle—moving air—is simple; but the applications are endless. Fans are taking the place of hand trucking—by blowing materials through pipes. They are taking the place of direct radiation—by supplying pure air heated *or* cooled according to outside temperatures. They are making many products better and cutting production cost at the same time. So varied are the profitable uses of moving air that they can be only touched upon in limited space—but the interesting book "Moving Air" covers the entire range. Are you losing time and profits by not reading it? The coupon below brings a free copy.

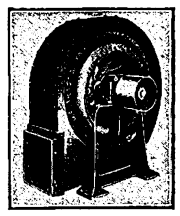


—in heating, ventilating, cooling, humidifying air conditioning, hot blast drying—

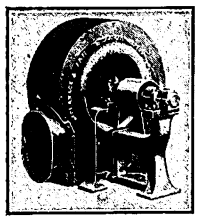
Fresh air is drawn from out doors by Clarage Fans; is heated or cooled and then blown to every part of factories, shops and offices. This system gives heating *and* ventilating at the cost of heating alone. In many installations the air is also washed and humidified by means of Clarage air washers.

In textile plants, cigar making and similar industries scientific humidity control is speeding production and improving the product. In paper mills heated air is used to dry roofs and stop the drip of condensation. Clarage multiblades are likewise used in many processes for hot blast drying. Clarage Ventilating Fans are described in catalog 52.

—for blast in forges, furnaces, cupolas—



Clarage Pressure Blowers are used to furnish blast for forges, oil furnaces, foundry cupolas, different types of industrial and chemical and metallurgical furnaces. Where higher air pressures are required, as in supplying air to gas generators, larger cupolas, furnaces, etc., the Clarage Type P. Blower gives air pressures up to 42 inches water gauge. Moderate pressure blowers described in catalog 22. Higher pressure blowers described in catalog 24.



—for removing shavings, dust, fumes and for pneumatic conveying—

Clarage Exhausters are paying dividends by removing gritty dust that would damage delicate grinding machinery; by removing fumes from paint spray rooms; by removing saw dust, shavings and blocks from wood working machinery. This type of fan has also found wide use in pneumatic conveying of light materials. Materials are handled at a fraction of the cost of trucking. Exhausters are described in catalog No. 111.

—for supplying forced draft to boiler furnaces—



Clarage Steel Plate Fans are used for forced and induced draft for boiler furnaces. Fans for this service are in most cases special applications, and there is therefore no field of fan application where the specialized experience of the Clarage engineering staff is of greater value. Clarage Type R. Fans are described in catalog No. 32.

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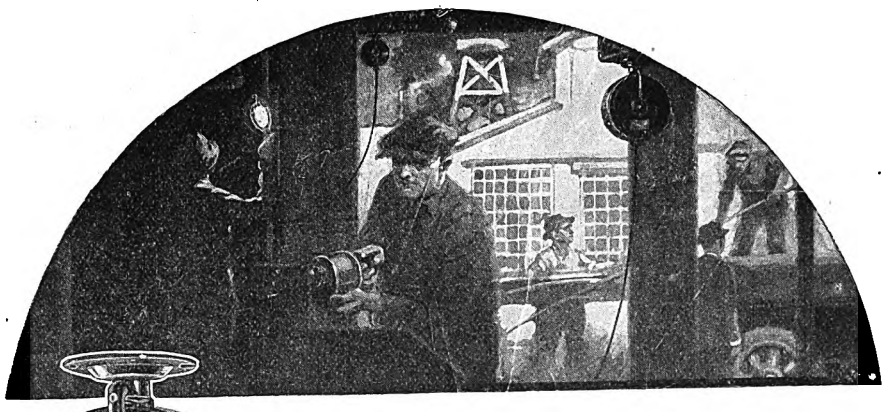
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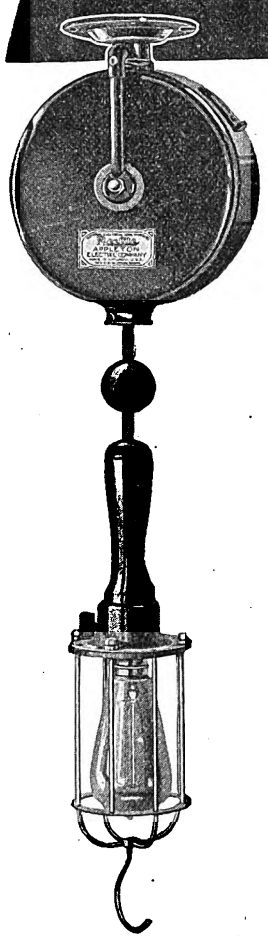
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The Cord Is Part of the Tool

Protect It to Keep the Tool in Use

The portable cord is the artery through which the power flows that keeps your tools productive. To avoid delays and accidents it must receive the same careful attention that is given the tool itself.

A **Reelite** will keep your light and power portable cords neatly coiled in its steel container, free from kinks, breaks or tangles. It will pay out the cord as needed and then retrieve it automatically when the job is finished. The action is similar to that of a window shade.

Reelites are built in all sizes—from a tiny one designed to handle 10 feet of lamp cord to the big Mogul Type that will take care of 125 or more feet of heavy power cable. There is a **Reelite** adapted to each and every one of your power or light extension requirements. When once installed they will soon pay for themselves in convenience, reduced cost of cord maintenance, increased production and elimination of accidents.

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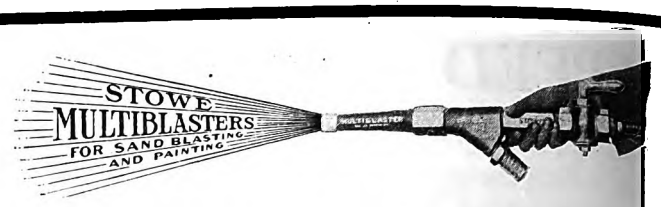
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The labor and time saved by the MULTIBLASTER may be gauged by the fact that one outfit will replace 6 hand workers on metal surfaces, and 18 to 30 men on wooden or concrete surfaces.

The MULTIBLASTER does a better job with less sand or paint. Positive and uniform distribution is assured by the fact that the paint is drawn into the spray by suction, keeping the ingredients stirred up. There is much less paint wasted as compared with the brush method.

MULTIBLASTERS require no tanks. Sand is syphoned from pit, barrel or pile—paint from any container.

There are several thousand MULTIBLASTERS in use, all sold subject to trial, and paid for.

	Price	Weight lbs.	Hose Suction	Pressure In. lbs.
Standard Size Sand Blast	$30.00	8	1	80-90
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Paint Spray	12.00	2	½	40-50



"The Man Behind the Gun"
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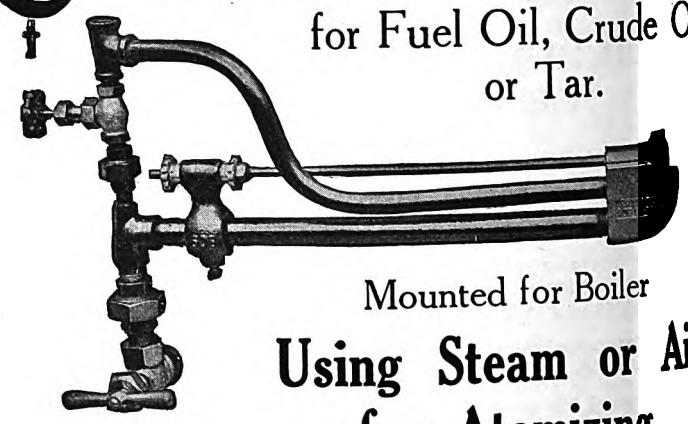
Prove its value before you pay for it. Any outfit shipped for 10 days' trial, via express or parcel post, ready for instant attachment to your air lines.

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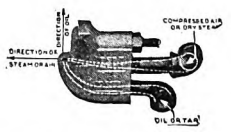
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for Fuel Oil, Crude Oil or Tar.



Mounted for Boiler

Using Steam or Air for Atomizing



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Note direction of arrows, The air or steam meets the oil at right angles, thus thoroughly atomizing the oil externally. This prevents *Clogging or Carbonizing* The burner is always clean.

WE HAVE been manufacturing liquid fuel burners for the past 33 years and we can safely say that the "CALOREX" is the most economical fuel burner to operate.

The "CALOREX" is simple in construction—no parts to wear out. It will last a lifetime.

It gives the most economical way to change boilers from coal to liquid fuel.

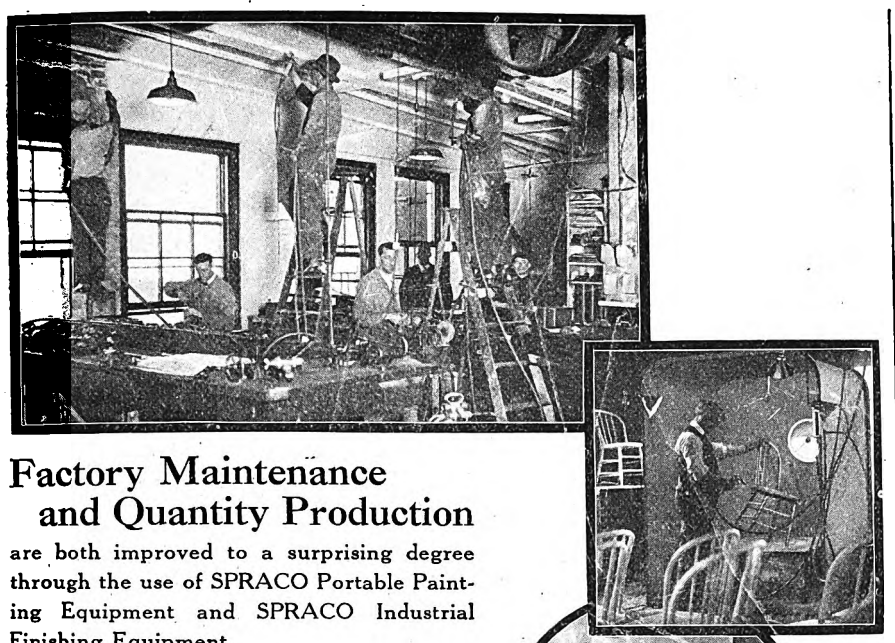
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When you know the features of the New Detroit Belt Cutter you will agree that no belt user can afford to be without it.
The knife arm lifts to make it easy to apply the belt. It squares a belt with perfect accuracy—fully guaranteed.

Made by the makers of "DETROIT" Belt Lacing and Closing Machines

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Made in two sizes—6" and 10". Write for folder. Order now if you want delivery within 30 days.



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(*Continued from page 46*)

ter materials handling methods it does not interest them, when it is to their advantage to investigate. Through inquiry, they will, it is reasonable to suppose, discover many places where better materials handling methods and equipment can be used to good advantage.

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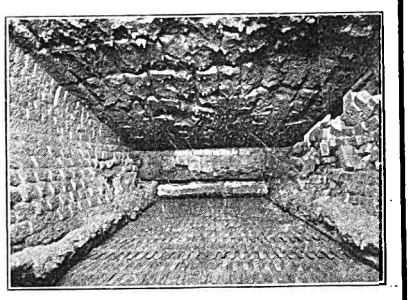
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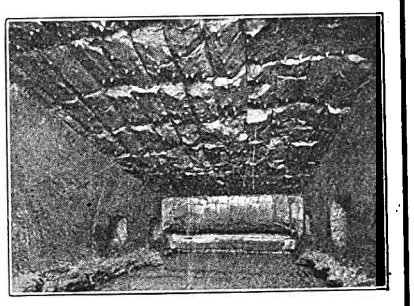
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The upper photo below shows a firebrick lining after a period of service. Lower one shows Plibrico Lining after same service.





Just one difference ---the lining

ONE difference—but what a vast difference it is!

In the upper photo, the crumbled side wall is an unanswerable argument against laid up firebrick; below, the staunch, *jointless* walls are a sermon for Plibrico.

Both photographs are of the same furnace, taken after the same amount of the same kind of service. And the result is no reflection on the quality of refractory used in the brick furnace. *The trouble started at the joints.*

Doesn't this illustration substantiate the conservative claim that Plibrico will outlast built up linings two to four times? Doesn't it prove that although Plibrico costs little more, it is worth at least twice as much?

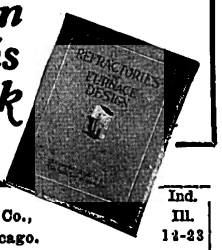
Plibrico is the highest grade refractory in the most usable form—plastic, so that it can be pounded and molded into any required shape by anyone who can swing a mallet. When vitrified it forms a rock-like one piece lining that withstands temperatures to 3100° F.

It is described in the big book shown below—"Refractories and Furnace Design."

Plibrico is delivered only in steel containers of distinctive appearance as shown below. Warehouse stocks in 60 cities—see phone books.

PLIBRICO FURNACE LINING
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The coupon brings this **FREE** *book*



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Please send me the 32 page booklet "Refractories and Furnace Design"—no obligation.

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Cuts the Cost of Reclaiming Coal

USED in conjunction with other equipment or used alone, the Scoop Conveyor is a mighty handy machine to have around for reclaiming or transferring coal from storage pile to boiler room.

It is ideal for loading small hand cars, electric dump trucks and similar equipment which in turn carry the coal into the boiler room. When the coal storage is not too far from the plant, two or more conveyors can be placed in tandem style, one feeding to another, and thus by feeding one machine the coal is delivered direct to the boiler room.

Well balanced construction permits extreme portability so that the machine can be easily moved about the yard.

Of course the same machine is used for unloading cars, storing coal and loading trucks or wagons. Any kind of coal, coke, ashes, sand, gravel, stone, etc., can be carried on the machine.

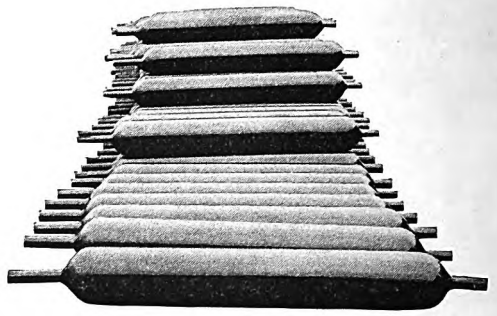
Thousands of users have found the Scoop Conveyor an extraordinary good investment.

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THE SCOOP CONVEYOR

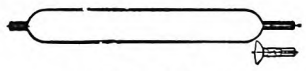


SEAMLESS DRAWN STEEL HOLLOW ROLLERS

Whenever rollers are used, Conveying Systems, Steel Mill Tables, and the like, maximum neck-strength is required because here the strain is most severe. Wharton rollers are made in one-piece—not welded. They are well balanced, and on account of shape when necked down maximum strength is obtained.

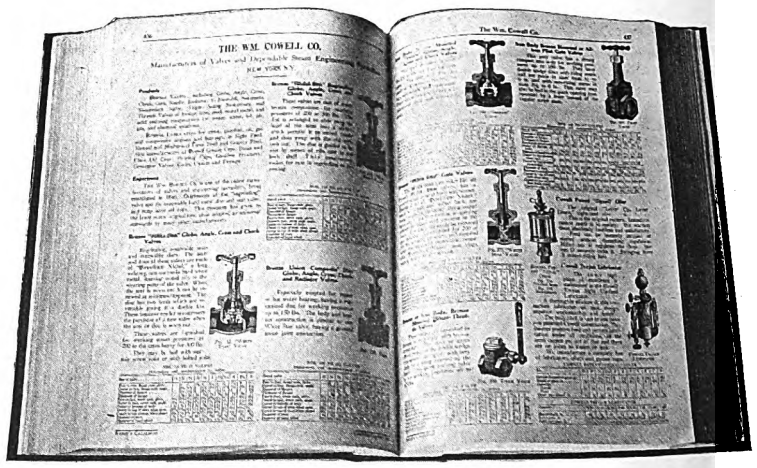
Yet, because they are hollow they are light in weight—saving in freight—easy to handle—lower power cost. Built only on order to meet customers requirements. Submit your problem to us—send sketch or blue print and give dimensions required.

We are also manufacturers of short lengths of large sized seamless tubing to fit unusual conditions. The manufacturing experience of our several plants is at your disposal.



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Keeping the Wheels Turning

(*Continued from page* 13)

should be oiled regularly, as they often run out of oil and cause trouble. Clutches require similar attention and should be adjusted so that they work easily. On tight and loose pulley countershafts, the belt from the main line should be lined up so that it will not creep over onto the tight pulley. This might cause an accident to the operator if he happened to have his hand on the machine.

When machines are installed in an erecting shop with a high ceiling and an overhead crane, the best way to drive the machines is the individual motor drive. This is expensive in first cost and is not always feasible. In this case, a steel or wooden beam harness work can be anchored to the wall and on this, the usual countershafts and main line can be hung. In order that the operation of the crane may not be interfered with, these machines and their overhead harness work should not jut out into the room any farther than is necessary.

Now that most motors are hung upside down on the ceiling, they are rather hard to put in place. An excellent method of raising them to the ceiling is by using a portable elevator or tiering machine on which a high cradle has been built, or else if there are many motors to install, the platform of the elevator can be turned upside down so that it will go up higher.

When a motor burns out, as occasionally happens, the advisability of using motors of standard size throughout the plant is driven home. If a replacement can be made with an identically similar motor, it is a comparatively easy matter to make the change because pulley sizes and length of motor belt remain the same. If a different type motor is installed, pulleys may have to be changed and motor belt lengthened or shortened as the case may be.

It is well to remember when planning belt drives that narrow thick belts are better than wide thick belts. With a belting table, the proper width and thickness can be selected, but it is a good idea to use a belt a little too big rather than one a little too small.

Several kinds of belting can be used in the average plant, such as leather, woven fabric, canvas and rubber. Each of these have characteristics which make them particularly well fitted for some special jobs, either on account of the conditions of the drive itself or by the exterior conditions such as moisture or heat. Inasmuch as leather is more extensively used in general shop use, it will be treated more in detail. The quality of leather in a belt and the method of joining the various pieces of hide together has an important bearing on the service which can be expected. It is important therefore that motor drives and all main drives should be of first grade belting.

For maximum economy, the speed of belts is variously given as between 4,000 and 5,000 feet per minute. Many drives cannot take advantage of this economy and therefore require wider and thicker belts than if the linear belt speed were increased.

More JEFFREY Labor-Saving Devices Means More Profits

Jeffrey Labor Saving Devices offer today one of the greatest opportunities for increasing profits. They increase storage capacity, conserve waste space, increase production and save expensive building expansion.

Wages spent for Human Carriers is gone forever, same as rent. An investment of an equal amount in Jeffrey Material Handling Equipments returns 50 to 100 per cent. and more for a period of years.

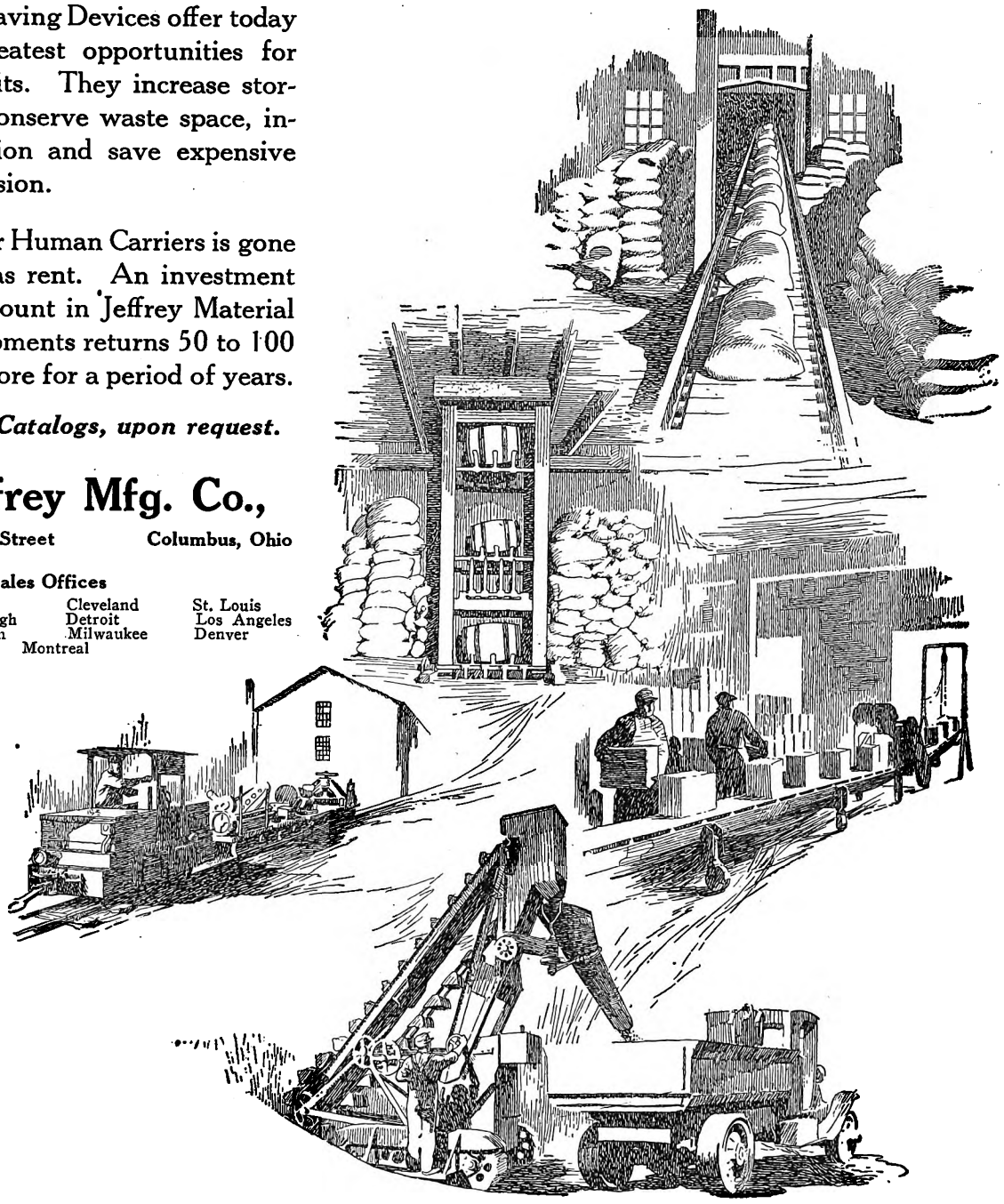
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Correct belt tension is very important. When a belt stretching machine is available, each new belt should be stretched before installing it. If this is correctly done, this method eliminates at least some of the time required later on to tighten the belt after it has stretched in service. Important belts should be taken up every couple of weeks until they are fully stretched. Good belt dressing applied now and then will sometimes make a belt pull as it should. However, if a drive requires continual belt dressing something is wrong.

A great many belts break at the lacing, especially when laced with metal lacing. Care in hammering the metal lacing into the belt will lessen this trouble. Up and down belts on machines where the operator shifts the belt, such as stepped cones, should be laced with pigskin in the good old fashioned way, or else if metal lacing is used, the ends of the lacing should be carefully turned in and pressed into the belt. A soft pigskin or a piece of soft, heavy string should be used to join the metal lacings on these belts so that there will be no chance of cutting the operator's hands. Machines equipped with belt shifters do not require any such care.

A power driven belt lacer will soon pay for itself in the millwright department, as it is much faster and will lace large belts easily. Each gang should have as part of their equipment a hand belt lacer so that they won't have to return to the millwright department to lace a belt.

Because motor belts run at high speed over rather small motor pulleys, they should be endless, that is, glued together. A board with metal clamps is required if a good job is to be done. The length of the lap depends on the width of the belt, both ends are shaved down evenly and are glued together and held in place on the board until the glue has set.

The subject of crossed belts comes in for attention when one thinks of power losses, because they consume more power than open belts. If a room has a good many intermittently used machines driven by crossed belts from the main line to the countershafts, it may be worth while to put open belts from main line to countershafts and crossed belts down to the machine. This will save power while the machines are idle. This, of course, should not be attempted on stepped cone machines. Sometimes there are places where much more than a majority of the machines are running with crossed belts; if this majority is large, it may be advantageous to reverse the direction of rotation of the main line.

Rolls of new belting in the millwright stockroom can be mounted on rollers in a rack built to fit the various widths of belt. If the rack is at the end of the room, the belt can be pulled out on the floor, measured and cut to length. Where a fireproof oil storage room is provided, it is usually to draw small quantities of oil and grease at frequent intervals.

Pulleys of pressed steel are largely used on account of their strength and light weight. With high speed shafts and small diameter steel pulleys, a fine installation is effected. Where an absolutely true surface is required, or where the diameter must be exact, cast iron pulleys are used.

The "CUB" will load it easily



Does the Work of 12 Men for the Wages of One

HERE is the famous Link-Belt "CUB" Portable Belt Conveyor—the sturdiest of all loaders of its size—a veritable "Bear" for work.

It is known for its reliable performance in the loading of coal, gravel and similar materials throughout the entire country. It is a Link-Belt GUARANTEED Product. It knows no superior in construction, performance or loading capacity.

Price—$550 f. o. b. Philadelphia or Chicago. 2-H. P., 2 or 3 phase, 60 cycle, A. C. motor, 21-ft. conveyor length, 18-inch wide belt assuring large capacity, belt guaranteed against cutting or fraying; wide loading hopper at foot of conveyor is hinged—easily and quickly opened. So simple and sturdy anybody can run it. Order at once for prompt shipment.

Catalog 550 on request

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World's Largest Builders of Elevating and Conveying Machinery

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Wooden pulleys, though not generally used in modern machine shops, are good for special services.

There are four types of drives used in transmission work. The most universally used is the belt drive and we have therefore treated it at considerable length. When a belt drive is not suitable, the chain drive, gear drive and rope drive are used.

Chain drives are especially desirable for motor drives where the motor is hung from the ceiling or overhead harness work. A chain drive on centers of less than three feet makes a fine installation and where space is limited, is very economical. The usual type of chain used on this service is the type with teeth cut in the chain itself. These teeth mesh with teeth cut into the sprocket. The motor should be mounted on slide rails so that slack can be taken up when the chain stretches. A sheet iron guard around the chain also serves as a reservoir for soft grease and a chain running through this grease in the lower part of the guard will last much longer than if it were greased only occasionally, as the chain has a tendency to throw off excessive grease. When speeds are slow on chain drives, or when the service is severe, a roller type or cast link type of chain may be used. These types are usually used on conveyors or drives from one shaft to another on heavy machines or equipment. These chains, especially the roller type, should be oiled or greased occasionally, but as they are often installed in places hard to get at, they rarely receive the lubrication they should get.

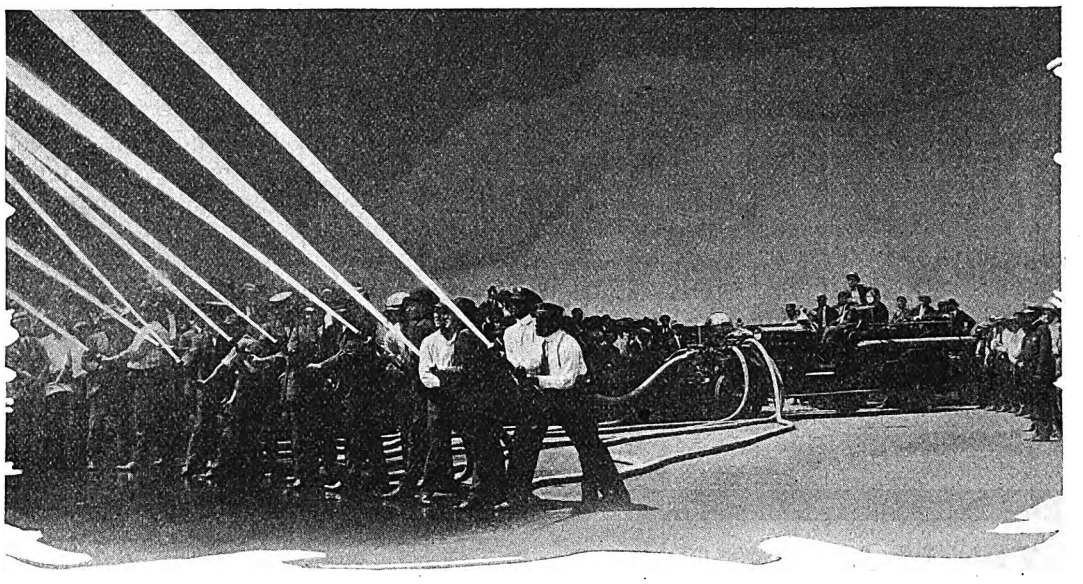
There are two general types of gear drives; spur and bevel. On machines, these drives are universally used, but as far as the millwrights are concerned, they are not usually used except on heavy drives on large equipment. Gear drives must be at correct center distances if they are to wear for the length of time they should, and they require greasing with heavy grease.

For very long drives or for drives exposed to the weather, rope drives are very good. They are often used for transmitting power at right angles. However, as electric motors are becoming more and more universally used, the necessity of using long or outdoor drives is gradually decreasing.

With wooden floors, machines may be easily bolted to the floor. Concrete floors, however, make it necessary to use an expansion shield or wooden plug so that lag screw will hold firmly. An electric or air driven hammer is almost a necessity if many machines are to be fastened, as quite a large sized star drill has to be used in order to get a hole big enough for the expansion shield. Sometimes the floor is not perfectly level, and in this case, each machine should be carefully leveled up. Common shingles make an excellent wedge for this work. After the machine has been bolted down, the parts of the shingles sticking out can be cut off with a chisel. Several methods are used for lining up machines with the main line. A steel tape, or a hardwood measuring stick are two methods largely used. Proper lining up is very important, as bearings will wear on one side, and belts will not run true if machines are not lined up.

Belt, roller, gravity and elevating conveyors are all used

SKF



Twelve Streams from One Engine
1400 Gal/Min. Capacity, Ball Bearing Equipped

TWELVE streams are possible from this fire engine of 1400 gallons per minute capacity. Imagine the headway a fire would make if the pumps on this engine broke down due to bearing trouble—if all the twelve streams failed at one time.

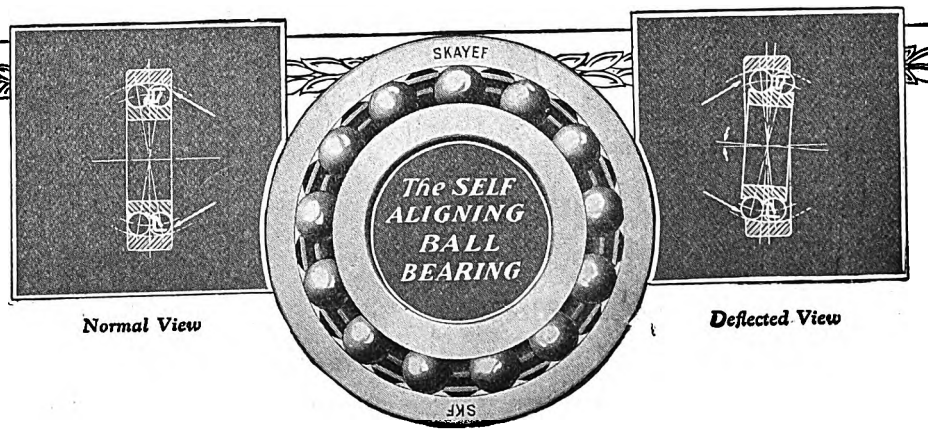
To guard against the failure of this large fire fighting unit when responding to an alarm and when fighting the flames, Skayef self-aligning ball bearings are used on the jack shaft of the chain drive for propelling the engine and on the pinion shaft of the pump drive.

Made of chrome alloy steel hardened uniformly throughout, this type of bearing has great endurance. Furthermore it develops no appreciable wear in service even under conditions of misalignment which would cause plain bearings to bind, heat and ultimately fail.

Because of their stamina and precision SKF marked ball bearings are invariably preferred by experienced users on machinery of all kinds. Our engineers will gladly submit recommendations for applying ball bearings to your machines.

THE SKAYEF BALL BEARING COMPANY
Supervised by SKF INDUSTRIES, INC., 165 Broadway, New York City

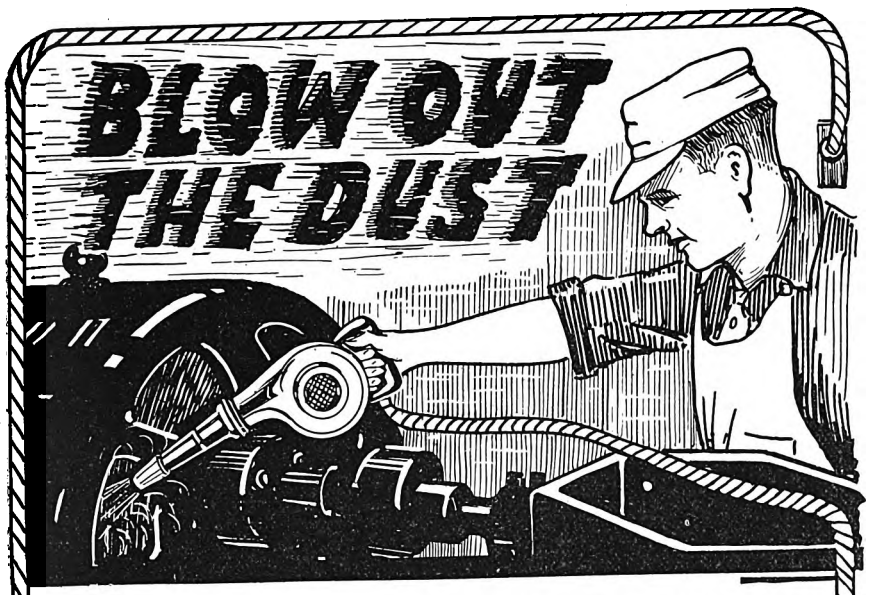
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BALL BEARINGS
The Highest Expression of the Bearing Principle

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With a **CADILLAC** Portable Electric **BLOWER**

The handiest and most practical blower for blowing dust and dirt out of armatures, field coils, switchboards, machinery, line shafting, stock bins, shelves, etc.

Lowers fire risks. Makes more healthful working conditions. Reduces depreciation in electrical and other machinery.

Weighs only 6 lbs. Complete in itself and requires no expensive installation or equipment. No condensation as with compressed air. Attached to any light socket.

The CADILLAC BLOWER has proved its worth and is performing successfully with hundreds of uses in shoe factories, cotton mills, grain elevators, coal mines, engravers, printers, wood working plants, textile mills, box factories, and every line of industry.

Write for descriptive folder giving prices and testimonials by leading manufacturers.

CLEMENTS MFG. CO.

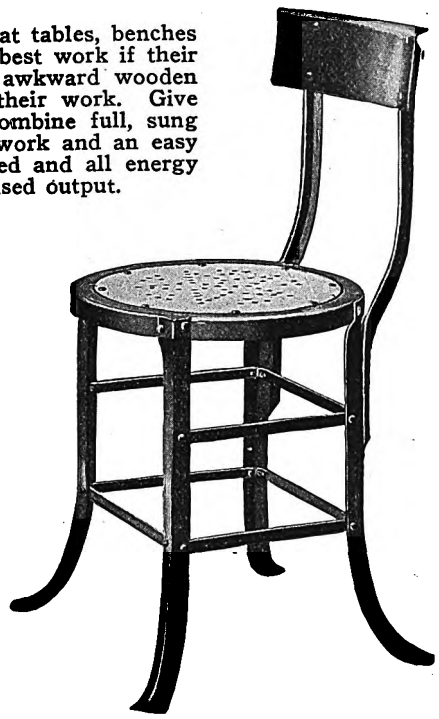
Manufacturers of the Cadillac Electric Vacuum Cleaner

612 Fulton Street, Chicago

Canadian Factory: 76 DUCHESS ST., TORONTO.

Chairs *Do* Make A Difference In Output

Men and women who sit all day at tables, benches and machines—can they do their best work if their bodies are tense and tired from awkward wooden chairs? Such fatigue slows up their work. Give them comfort with chairs that combine full, sung back support, height to suit the work and an easy rest for the feet. Fatigue is saved and all energy used for work. The result—increased output.



METAL MEECO PRODUCTS

COSTS ARE LESS—

With all these advantages Meeco Steel Chairs cost you less than two cents per day per dozen with our five year guarantee. Could you buy good wooden chairs and keep them repaired five years for that price? The investment is an economy from the start. Get the new illustrated catalog. You'll find the Meeco Steel Comfort Chair will make better workers on your factory jobs. It means an increase in output you never realized.

Write for Illustrated Catalog

Manufacturing Equipment & Engineering Co.

Factory and General Offices

Framingham **Mass.**

for handling materials throughout the plant. Moving and wearing surfaces require oiling and greasing if they are to continue to give service. These conveyors frequently pass through rooms containing more or less dust and bearings will collect this and in time become ground out. Conveyors are installed to replace human labor, but don't let your desire to cut down the cost of handling keep you from taking proper care of your handling equipment. Coal conveyors are very important, so that spare parts should be kept available. When several months' or years' records have been kept of the spare parts required to keep conveyors running, those parts should be kept in stock. Coal handling equipment, from the crusher under the cars all the way to the stoker on the boiler, must operate every day under all conditions of cold and wet weathers, and it is therefore advisable to have the daily inspection cover this equipment so that small defects can be fixed before they get serious.

A very important item in the inspection of equipment is elevators. This inspection of elevators will include the electrical as well as the mechanical parts. The millwrights as a rule take care of everything connected with the elevator, except the electrical part. The machine should be oiled daily, and worn or broken parts should be replaced at once from the spare parts kept in stock. In this way no elevator will be out of commission very long. If all the elevators are working to their capacity during the day, any repairs, even of a routine nature, should be done in overtime. Cables will become frayed gradually as they wear, and they should be replaced when six strands are broken. The various factory and insurance inspectors will insist on this, but it is best to play safe and if cables go bad at any time, they should be replaced at once, and not wait for official instructions. Safety devices are designed to hold the car, even though the cables should break, and they, therefore, should be carefully inspected periodically. Every year the guides for the car itself should be lined up. Running heavily loaded trucks onto the elevator tends to throw the guides out of line and sometimes loosens the bolts holding the guides. In this case it is neces-

(*Continued on page* 56)

Cost Less-Weigh Less and Live Longer

No weight except where weight is needed



From Drawing Board to "Nesting"

Lewis-Shepard Lift Truck Platforms are planned, designed and built with exacting eye for

MINIMUM WEIGHT

Moreover—the design of the Lewis-Shepard Lift Truck Platform insists on *all pressed steel,* scientifically folded and formed so as to *secure* this minimum weight and at the same time *insure* MAXIMUM strength.

Lewis-Shepard Lift Truck Platforms

(1) Weigh less
(2) Nest easier
(3) Fit any type of truck
(4) Live longer because they're stronger

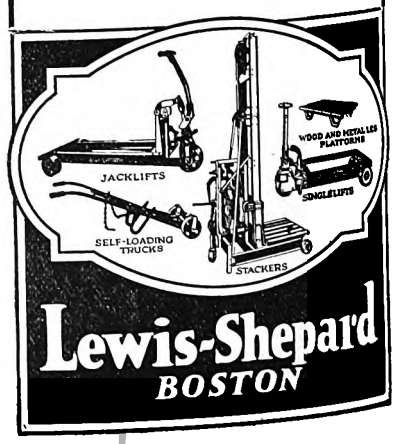
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"You're running your factory as you would a farm"

THOSE are the words of an engineer who was brutally frank to the president of a company employing fifteen thousand men.

What he meant was that, in the company's huge factory, the machine operators were not only doing their regular work but keeping their own time on each job lot as it passed through their machines.

Like a farmer, each operator was doing more than his routine work each day.

Unlike the farmer, much of this could have been done by machines.

The Calculagraph automatically records on the job ticket, the starting, stopping and *elapsed time*. No time is lost by the workman computing the elapsed time. The Calculagraph records that mechanically.

Think this matter over. If you want to save time for your operators, time clerks and payroll staff, write for our booklet "Elapsed Time Records."

The Calculagraph Company

34 Church Street **New York**

The Calculagraph is being used successfully in the following industries

- Aluminum Wear
- Ammunition, Guns, etc.
- Auto Accessories
- Auto Painting, etc.
- Automobiles, (Motors & Bodies)
- Bolts and Nuts
- Brass Goods
- Brushes
- Candy Mfgrs.
- Cans
- Carpets and Oilcloths
- Chairs
- Chemists
- Clothing
- Colleges and Universities
- Contractors
- Copper Goods
- Department Stores
- Electrical Appliances & Supplies
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- Flour Mills
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- Hardware
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- Knitting Mills
- Laces
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(*Continued from page* 54)

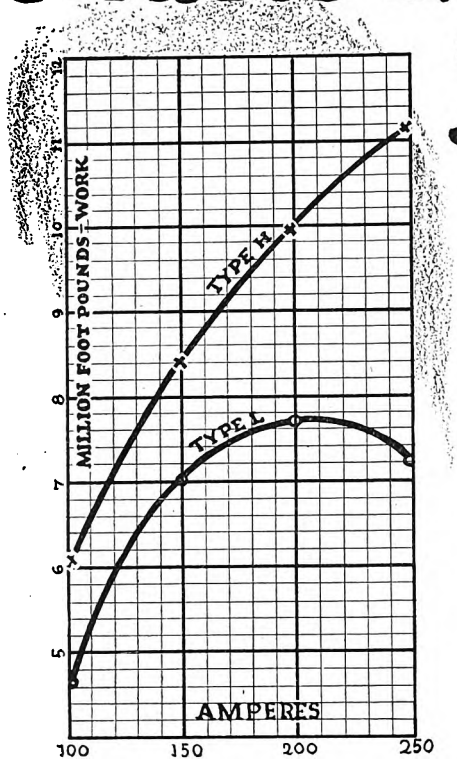
sary to change the location of the bolts or else grout long bolts through the wall. The weight guides are not subject to the same side thrusts as the others, but they should be lined up when doing the others. Elevator gates and doors are dangerous unless they operate properly and should be repaired immediately when they become damaged. The tinsmiths will take care of any damage to that part of the door.

Cranes of several different types are used throughout the plant, each one requiring individual attention. The large overhead cranes which serve the big erecting shops and foundries are the most important, and these should be inspected every day and a report made out on the condition of each important unit on the crane. These reports will show the condition of wearing parts, and these can be replaced long before an actual break occurs. Some minor repairs can be done while the cranes are operating. As in the case of other important units, the spare parts stockroom should have on hand any and all parts subject to hard wear or breakage. Lifting cables, together with their blocks and drums, should be inspected and kept in good order. The running gear is not so important as the lifting mechanism because a small break wouldn't cause as much damage. Nevertheless, it should be carefully oiled and watched. The operator usually oils and greases his own crane so there can't be any alibi in case of lack of oil. The beams and rails should be lined up every six months to a year. If the loads are light, the rails don't pull out of line much. Small cranes and jib cranes are not so important, but a little time given to inspection and care will be well invested. The chances of an accident are also lessened.

There are two ways to guard machinery and equipment. First, guarding to standard specifications which are laid down by the insurance companies. By this method of guarding, a substantial reduction in the compensation insurance premium is made. Second, guarding to prevent the average accident. This method is of course much cheaper in first cost and if well carried out will eliminate almost all accidents. A great many plants, especially the larger ones, have found that it is good policy to guard every piece of machinery so well that it is almost impossible for men to get hurt. Even under these conditions, accidents do occur occasionally, and when an investigation is made and a defect found in the guard, that defect is immediately remedied so that same accident cannot happen again. The method of installing certain drives on equipment affects the safety department's work so the everyday work of the millwrights is tied up with the subject of guarding. All of us want to make each job as safe as possible, and by striving and working toward that end, much has been and much more will be accomplished.

While conditions in industry and trade remain highly irregular, there is little change in the volume of industrial employment or in wage scales, nor is the average of wholesale prices much altered by the individual fluctuations from week to week. —(*Guaranty Survey.*)

Make Each Ampere Do 25% More Work



WHEN you consider industrial tractors, don't be satisfied with good results. Get the best. Why accept 4¾ million foot-pounds of work when you can get 6 million?

Look at the curves! The full-grown one shows the work produced by the new Mercury Type H internal gear tractor for various power inputs. See how it towers over the other curve representing the work you can get from the same energy expended in the best of the conventional worm drive models.

Think what this 25% "plus" work would mean in your own case—the ability to haul more trailers on each trip—to load each trailer more heavily—to operate for a longer period before recharging the battery.

And in addition to the important saving in cost of operation, this increased capacity for work usually produces multiplied economies through the speeding up of your whole material handling program.

How The New Type-H Makes This Possible

Introduces a balanced internal gear drive of entirely new design, eliminating the friction losses inherent in the worm drive. This results both in low operating cost and an absolute minimum of upkeep for the "power plant."

Retains all valuable features developed in previous Mercury models including:

1 Special safety features effectively insuring against danger, even in the hands of inexperienced workmen.

2 Drum type controller of special design having long life, dependability, simplicity, ease of inspection and adjustment.

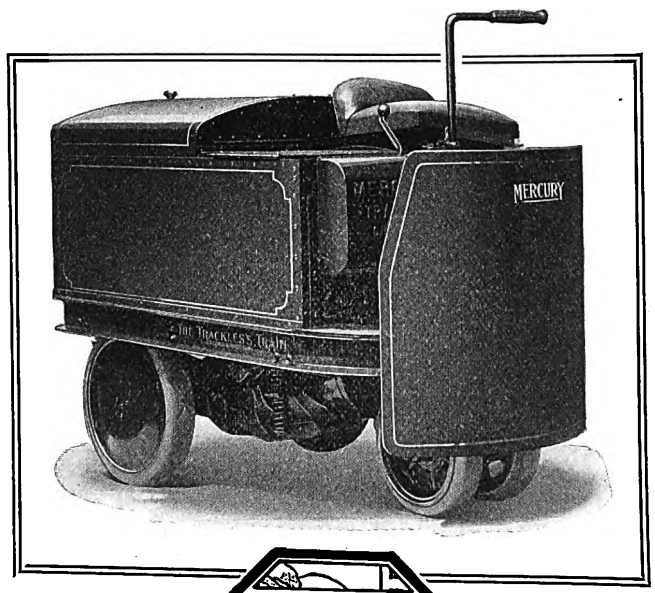
3 The exclusive Twin-3 front wheel assembly combining full spring suspension with the short turning radius of older 3-wheel models.

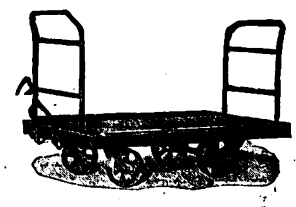
4 Frame of channels and angles hot riveted to combine maximum simplicity, rigidity and strength.

Fleet Owners

The Mercury organization pioneered in the field of electric industrial tractors, and for more than 8 years has made such tractors and trailers exclusively. It is therefore not surprising that a preponderance of all the large installations are 100% Mercury. A few of the large fleet users (over 10 machines) are the following:

American Railway Express Co.
American Radiator Co.
Armour & Co.
American Window Glass Co.
General Electric Co.
Endicott-Johnson Co.
United States Government
Studebaker Corporation
Sugimure Warehouse (Japan)
Willys-Overland Co.
United States Government
American Car & Foundry Co.
Kewanee Boiler Co.
Eastman, Gardiner Lumber Co.
Standard Oil Co.
Union Stock Yards & Transit Co.
Pennsylvania Railroad Co.
Sears, Roebuck & Co.
Illinois Central Railroad
Lehon Co.
Morris & Co.
Swift & Co.
Miller Rubber Co.
Chicago Tunnel Co.
Chicago Union Station Co.
Chicago Burlington & Quincy R.R.
New York Central System





Trailers

And to complete the "Trackless Train" there are Mercury trailers of just as distinctive merit as the tractor. There are various designs for special purposes, but the A-310, illustrated above, is an all-purpose trailer which meets most all ordinary industrial conditions.

Mercury Manufacturing Company



4112 South Halsted Street — *Chicago, U. S. A.*

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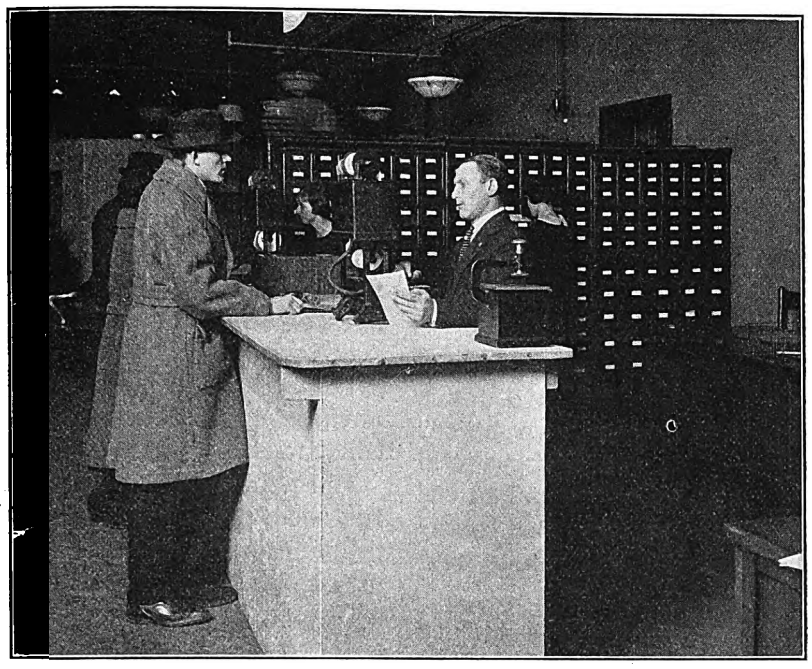


Fig. 1.—Showing interpreter at office taking application for service from foreign born resident, who cannot speak English, and transmitting same on Telautograph to Credit and Shop Departments. These instruments are shown mounted upon a temporary counter while moving office to new location.



Fig. 2.—Showing employees, examining records to clear credit on applications taken as shown in Cut 1, which records on instruments both at main office and shop.

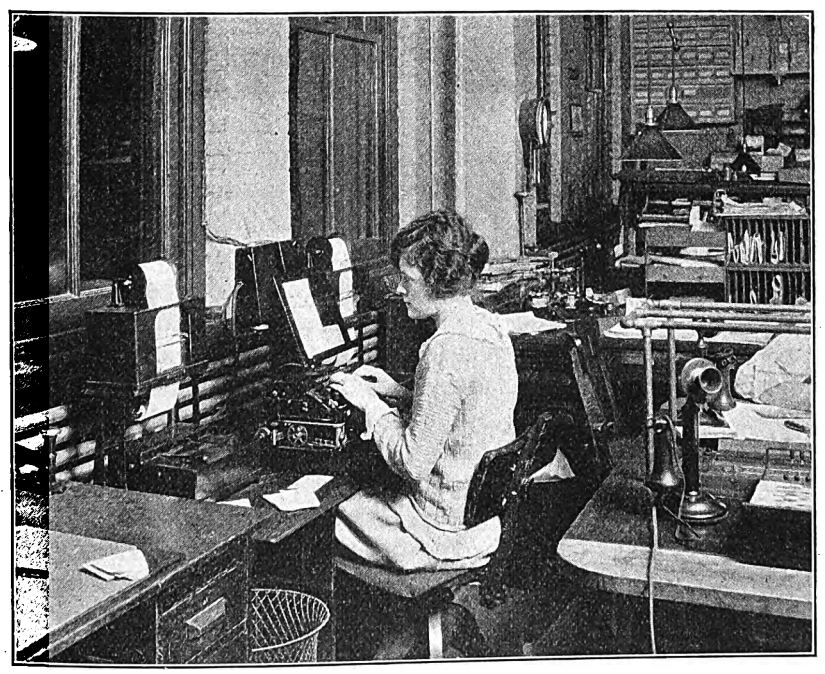


Fig. 3.—Showing operator at shop making up orders transmitted by Telautograph after credit has been passed. There is also shown on the right telephone order table at which applications for gas and electric service, complaints and leaks are taken.

RECORD OF SHOP ORDERS

Transmitted by the Telautograph January 8, 1923, to show time between actual receipt of order and execution of same. This does not include leak and miscellaneous orders received by telephone at shop.

Telautograph Nos.	Nature of Order	TIME: Application made by Consumer	Credit Passed	Further Credit Investigation	Order Given to Bill Jones	Bill Jones Arrived at Premises	Elapsed Between Taking of Appl. and Arrival of Bill Jones Hr.	Min.	REMARKS
"A" Machine									To be done 1- 9-23
1	Spl. Test	8.49	....	....	....	....	..	..	Bookkeeper only
2	G	9.20	9.21	....	....	....	..	..	
3	G	9.47	9.48	9.57	11.08	11.15	1	28	
4	Canceled								
5	Sales	10.00	10.39	....	12.00	1.35	3	35	Welsbach heater
6	E	10.14	10.15	....	12.00	1.00	2	46	
7	PS	10.17	....	....	11.21	1.35	3	18	CGI
8	Set G&E	10.18	10.19	....	12.00	5.05	6	47	
9	SG&E	10.19	....	....	12.00	....	..	..	To be done 1-15-23
10	Void								
11	G&E	10.25	10.26	....	....	....	..	..	To be done 1-20-23
12	ST	10.30	....	....	....	....	..	..	To be done 1- 9-23
13	G&E	11.00	11.01	....	12.00	1.30	2	30	
14	Spec. Elect.								
15	E	11.15	11.16	....	....	....	..	..	To be done 2-20-23
16	PS	11.18	....	....	12.00	1.50	2	32	
17	Complaint	11.20	....	....	12.00	4.00	4	40	
18	PS	11.20	....	....	12.00	5.20	6	00	
19	ST	11.21	....	....	....	....	..	..	To be done 1- 9-23
20	ST	11.38	....	....	....	....	..	..	To be done 1- 9-23
21	G&E	11.37	....	....	11.40	....	..	..	To be done 1-10-23
22	G&E	11.40	11.41	....	12.00	1.45	2	05	
23	SG&E	11.42	....	....	....	....	..	..	To be done 1-10-23
24	SG&E	11.45	....	....	12.00	3.00	3	15	
25	G&E	12.02	12.03	....	12.10	2.05	2	03	
26	Spec. Elect.								
27	Set G	12.19	12.30	....	2.42	4.00	3	41	
28	Set G	12.30	12.31	....	12.40	4.20	4	00	CGI
29	G&E	12.34	12.35	....	2.42	2.50	2	16	
30	PS	12.40	....	....	6.15	8.15	7	35	Wrong address
31	PS	12.40	....	....	3.00	3.40	3	00	
32	AR	12.45	....	....	....	....	..	..	To be done 1- 9-23
33	AR	12.47	....	....	12.50	3.20	2	33	
34	PS	12.48	....	....	....	....	..	..	To be done 1- 9-23
35	SG	12.50	....	....	2.42	....	..	..	To be done 1-15-23
36	G&E	12.56	12.56	....	....	....	..	..	To be done 1-10-23
37	ST	1.00	....	....	....	....	..	..	To be done 1- 9-23
38	Leak	1.40	....	....	1.50	2.30	..	50	
39	AR	1.46	....	....	....	....	..	..	To be done 1- 9-23
40	G&E	1.53	1.54	2.06	....	....	..	..	Bookkeeper only
41	G&E	2.06	2.07	....	3.27	4.15	2	09	
42	Spec. Elect.								
43	G	2.46	2.47	....	4.14	5.00	2	14	
44	PS	2.50	....	....	3.48	5.20	2	30	
45	ST	5.10	....	....	....	....	..	..	To be done 1- 9-23
46	ST	5.11	....	....	....	....	..	..	To be done 1- 9-23
"B" Machine									
1	SG	8.35	....	....	9.25	9.30	..	55	
2	PS	9.03	....	....	10.03	1.25	4	22	
3	G&E	9.09	9.10	....	10.23	8.30	..	..	Picked up by Bill Jones before disp'd
4	SG&E	9.10	....	....	10.23	9.30	..	20	
5	SG&E	9.25	....	....	9.55	10.30	1	05	
6	G&E	9.39	9.40	....	10.30	10.45	1	06	
7	SG&E	9.50	....	....	....	....	..	..	To be done 1-15-23
8	PS	10.00	....	....	....	....	..	..	To be done 1- 9-23
9	SE	10.24	....	....	11.10	11.20	..	56	
10	Void								
11	SG&E	10.40	....	....	....	....	..	..	To be done 1-15-23
12	Spec. Elect.								
13	G&E	10.48	10.49	....	12.10	2.30	3	42	
14	Leak	10.52	....	....	10.55	....	..	..	St. leak—Ref'd to Street Dept. 1 p.m.
15	SG	10.58	....	....	12.00	2.45	3	47	CGI

The Syracuse Lighting Co.

with Telautograph Service

Reduced the time *on completed operations* from two days to two hours and forty-eight minutes!

Rapid and accurate transmission of orders is the secret of this Revolution in handling Shop Orders and Operation!

Your Production can be speeded up by this fast Transmission of Reports. Just ask us about it—no obligation—ever.

We will send our booklet—or our man.

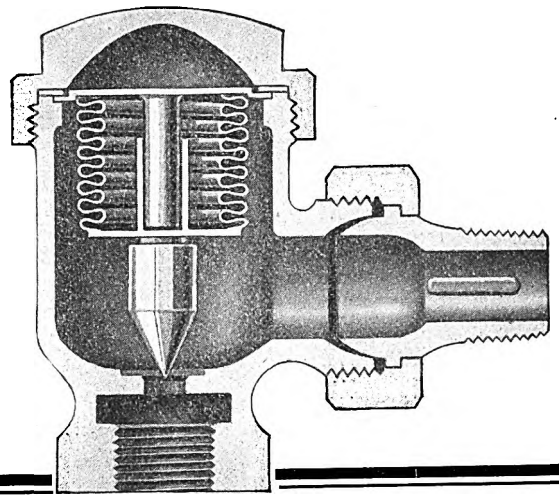
TELAUTOGRAPH CORPORATION

448 WEST 37th STREET NEW YORK CITY

Branches in 35 Cities **Service in 120 Cities**

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Making 100% Heating Installation EFFICIENT



With coal at present high prices, heating systems should be judged on the *saving of fuel* effected. And in order that it may operate at 100% efficiency as a whole, it must be properly trapped.

All radiator traps are not alike. To be positive that the condensate will find immediate egress, install the

Radiator Trap

SARCO

For instantaneous, positive, reliable action, the Sarco is in a class by itself. A very small quantity of condensate in the trap cools the thermostatic element, causing the vapor in the drum to return to its liquid state. This immediately restores the vacuum in the vapor chambers which in turn causes the element to contract and open the valve, discharging the water and air to the return. Steam following, at once reverses the action, closing the cone valve again.

The total lift of the cone valve from its seat, about ¼", permits of a free discharge, while its pressure on the valve seat, on return, is such as to prevent the escape of steam.

No other element, either flat disc or corrugated type, has such a long life as the Sarco element, due to the spiral (not annular), corrugations which distribute the valve movement over practically the entire drum.

When you install the Sarco you get year-in-year-out durability as well as efficiency.

Drop us a postcard for illustrated Booklet R-103.

SARCO CO., Inc.

236 Broadway, New York City

Boston Buffalo Chicago Cleveland Detroit Philadelphia
Peacock Bros., Limited, Montreal

What Do You Pay for Steam?

(*Continued from page 22*)

we want to know just where each heat unit goes and why.

Let us say that our Heat Balance is as follows:

	B.t.u.	%
Heat absorbed by the steam	7200	60.0
Heat in dry stack gases	2400	20.0
Heat of combustible in ash	720	6.0
Heat lost by radiation	960	8.0
Heat loss due to moisture in fuel	84	0.7
Heat loss due to burning hydrogen	600	5.0
Heat loss due to incomplete combustion	36	0.3
Total Heat in One Pound Coal	12000	100.00

Analyzing this record for a moment it requires no higher mathematics to see that the total heat in the coal is equal to the sum of the heat absorbed by the boiler plus the heat represented in the various losses.

The largest loss is the stack or dry flue gas loss, which comprises the sensible heat carried away by the gases leaving the boiler setting. The amount of this loss depends upon the quantity of gas passing from the boiler in a given time and its exit temperature.

Since this gas is the result of the combustion of the fuel, it is obvious that for every pound of coal burned the quantity of flue gas will vary according to the amount of air supplied for combustion purposes. An excess of air over what is actually required for complete combustion is harmful, because it absorbs heat from the hot furnace and carries much of this absorbed heat out of the setting with it. Expressed in another way, excess air cools the furnace temperature.

The amount of excess air in the flue gases can be determined by analyzing the per cent. of carbon dioxide (CO_2) which the gas contains. High percentages of CO_2 indicate the presence of very little excess air.

Suitable instruments are available for this purpose, the simplest of which is the hand Orsat. More satisfactory records are possible, however, with the use of a CO_2 recorder, which is really an automatic Orsat for making a continuous record upon a daily chart.

There may be several causes for the presence of excess air in the flue gases. First, the fuel bed may be full of holes, through which air is rushing without coming in contact with the live coal. Black spots in the fire bed indicate holes and should always be covered with green coal.

Too thin a fuel bed also permits the passage of excess air. For a given load, given draft conditions and given grade of coal there is a "best thickness" of fuel bed, corresponding to maximum combustion efficiency and minimum losses. This thickness is best determined by trial, using a hand Orsat for the determination of the CO_2 percentages for different thicknesses of fuel bed. The thickness which gives the highest Orsat readings is the correct thickness for the conditions.

Once the correct thickness of fuel bed has been determined, proper conditions in the bed may be maintained by the use of a differential draft gage, mounted upon the boiler front, within easy view of the firing floor. The gage is so connected as to indicate the pressure required to force the air through the fuel bed. If the bed is too thin, the draft gage reading is abnormally low. If too thick, the reading is high. If there are holes in the fire, the reading is again low.

By the intelligent use of these instruments and the correct interpretation of their readings excess air may be reduced to a minimum and one of the factors in the dry flue gas loss held well within control.

But the magnitude of the stack loss is also determined by the temperature of the gases leaving the boiler setting. This temperature may be measured accurately by suitable recording thermometers and pyrometers. These instruments are so installed that a continuous record is obtained of the temperature of the gases as they leave the boiler setting.

High flue gas temperatures may be caused by dirty boilers, either outside, inside, or both. Where the feed water is impure, frequent boiler cleaning may be necessary to prevent the formation of excessive scale deposits upon the internal surfaces of the drums and tubes. Such deposits act as an insulating jacket, preventing the efficient absorption of the heat in the furnace gases by the water in the boiler shell.

Soot and other deposits upon the external surfaces of the tubes has the same insulating effect. These deposits should be scoured from the tube surfaces at regular intervals with a steam hand lance. Where permanent soot blowers have been installed the blowing of tubes is not la-

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borious and it is possible to maintain clean tube surfaces without much difficulty.

Clean boiler surfaces are essential to the maintenance of high operating efficiency, minimum heat losses and minimum steam power costs.

High flue gas temperatures are also caused when the hot furnace gases take a short cut through the boiler setting instead of following their otherwise devious path. This short-circuiting occurs when the baffles have become cracked or broken. Thus the time of contact between the gases and the boiler heating surfaces is materially lessened, less heat is absorbed by the water and the gases leave the boiler setting hotter, carrying with them heat that would otherwise be available for the performance of useful work.

The existence of broken baffles of defective setting may be indicated by the use of a second differential draft gage, so hooked up as to read the amount of draft required to draw the gases through the setting. Broken baffles decrease the resistance to the flow of the gases, which condition is indicated to the fireman by an abnormally low draft reading. Abnormally high draft readings may be due to the presence of an excessive amount of soot deposits upon the boiler tubes.

In the normal operation of the average industrial boiler plant the dry flue gas loss is the largest of any of the heat losses. Nearly always it is excessive and sometimes it may be cut in half. Without adequate and accurate knowledge of what is happening within the furnace and boiler setting, however, this loss is not easy to cope with. Where suitable instruments are provided for furnishing the required information, it is usually the easiest loss to control.

It is not practical, however, to eliminate this loss entirely. To do so would require the complete combustion of the fuel, with no excess air. It would also require that the flue gases leave the boiler setting at the temperature of the boiler room. Complete combustion with no excess air is possible only in a laboratory under special and ideal conditions. Very low flue gas temperatures are actually attained when economizers are used in conjunction with the boiler units. But it is not possible, even theoretically, to reduce the flue gas temperature lower than the temperature of the incoming feed water, say 212 deg. F. In the average plant a 10 to 15 per cent. flue gas loss is considered very good performance.

Next in importance among the boiler room losses is the amount of unburned coal lost in the ashes. In power plant operation it is neither practical nor possible to burn all the coal on the grate down to an incombustible ash. Slicing, shaking and dumping of the fires always carry some green coal into the ashpits.

Load requirements in boiler house operation do not permit long periods for careful cleaning of the fires. When considerable ash has accumulated upon the grates it must be got rid of as quickly as possible. The good coal is winged back and the grates dumped and covered again with all possible speed.

In stokered plants this loss is apt to be less because of the better control possible, through being able to burn down the coal that is on the dump plates before

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With the ever increasing tendency towards higher steam pressures and higher temperatures in power plant practice, we have added a new type Troy Engine to supplement our line of standard types.

The New Troy Engine retains all the features which have made the name Troy a symbol of economical engine operation, but is of **heavier design** to **fully utilize the higher temperatures** and **steam pressures** coming into use. The New Troy meets the demand for

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It is designed for the greatest durability and for the least delay and expense when worn bearings must be replaced. The number of parts which may wear and need replacement has been minimized.

The engine is designed with the Troy **steam tight admission valve** and is self-oiling—the circulating system supplies each bearing with a copious amount of lubricant. Yet, the working parts of this system are very simple and involve very slight wear.

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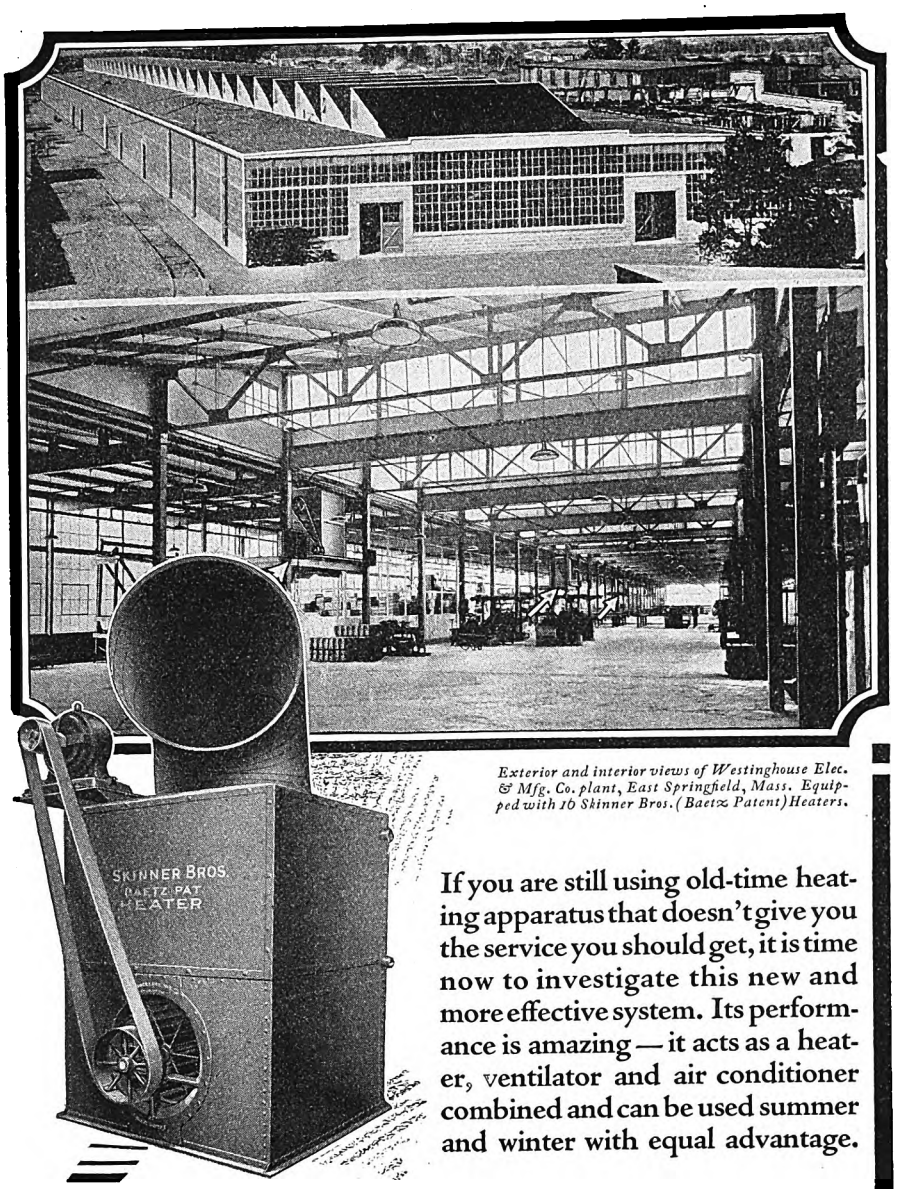
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If you are still using old-time heating apparatus that doesn't give you the service you should get, it is time now to investigate this new and more effective system. Its performance is amazing — it acts as a heater, ventilator and air conditioner combined and can be used summer and winter with equal advantage.

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4th — It is sold on a definite guarantee basis.

The Skinner Bros. (Baetz Patent) Heater is so superior to old unsatisfactory types that it has been adopted by many industrial users in the U. S., such as Ford Motor Co., Quick Meal Stove & Range Co., Federal Foundry, Castanea Paper Co., St. Louis Independent Packing Co., and others.

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Skinner Bros.
Baetz Patent HEATING SYSTEM

letting the refuse down into the ash pits. A certain amount of live coal on the live grate area, however, usually avalanches and follows the ash into the pit.

Cleaning fires is a hard and hot job. There is not much time to be particularly nice about it. Nor is there usually the inclination. The main idea is to get the boiler back to work as soon as possible. The result is that considerable good coal "goes to glory" with the ashes. This loss is always greater with a high-ash coal than with a low-ash fuel, because where there are more ashes to be disposed of there is bound to be more good coal carried with them.

The important thing is to use every care in cleaning fires consistent with the load requirement of the plant.

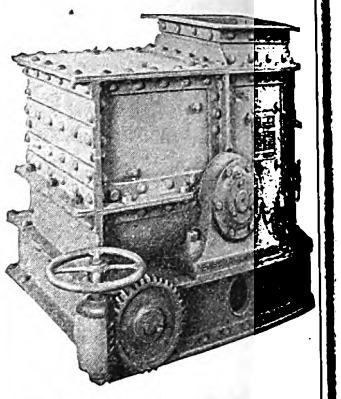
Heat is also lost by radiation from the boiler and setting. In older plants, where the insulation is in bad condition, this loss may exceed 10 per cent. of the heat in the coal. Where the boilers and setting are well insulated, however, the radiation loss may be as low as 5 or 6 per cent.

Other boiler operating losses are relatively unimportant, because they are more or less beyond the control of the men handling the boilers and because they are very small losses at best. This applies particularly to the moisture and hydrogen losses.

Incomplete combustion is the result of insufficient air for combustion. Nearly every industrial boiler plant suffers from excess air. We may, therefore, safely pass up this possible loss as nothing to worry about. When the CO_2 recorder shows percentages, it is time to do one of two things, perhaps both. First, look for incomplete combustion due to insufficient air supply. Second, look for a possible error in the instrument reading.

Production of gasoline in the United States in October amounted to 659,060,570 gallons, constituting a new monthly record, states the Department of the Interior as a result of statistics compiled by the Bureau of Mines. Notwithstanding this record production, gasoline stocks on hand at refineries November 1 amounted to but 946,872,683 gallons, a decrease of 25,832,149 gallons, as compared with October 1.

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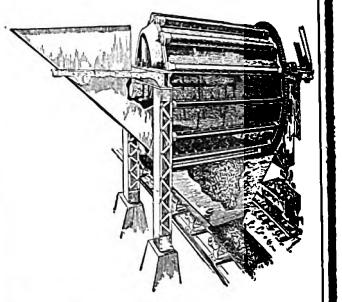


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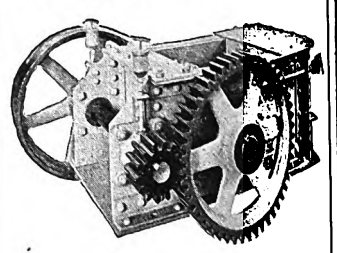
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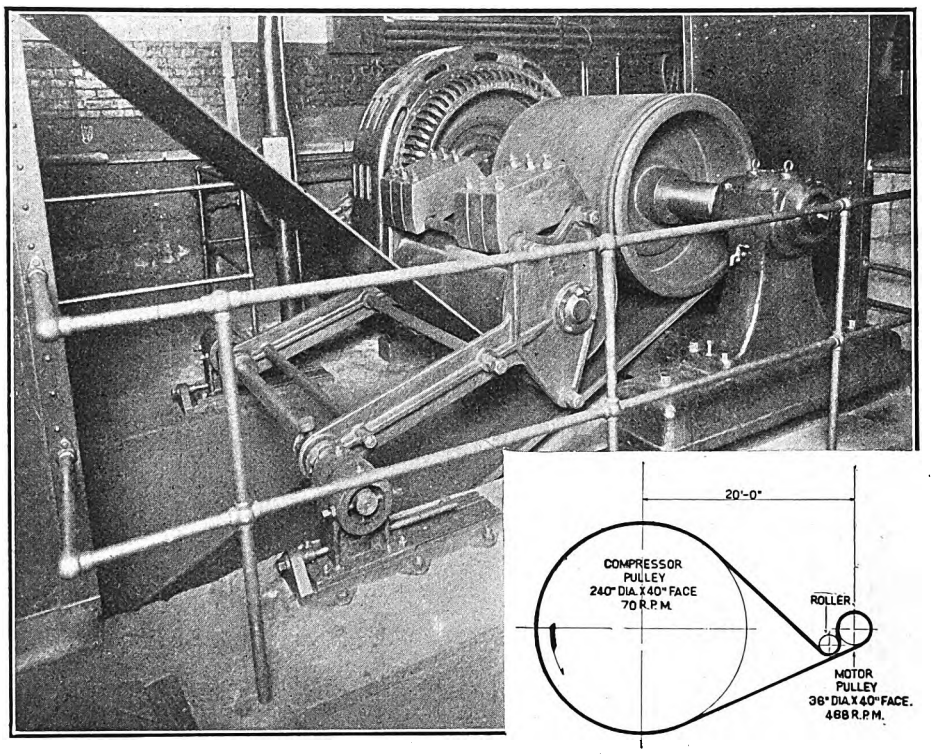
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FIVE POINTS

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3—The Lenix saves floor space, building space and belting because of freedom in pulley locations.

4—The Lenix saves in bearing friction, lubrication and renewal of bearings because of reduced bearing pressure.

5—The Lenix permits the use of less expensive, high speed and high efficiency motors or generators because of the higher pulley ratios.

The increased arc of contact created by the Lenix makes it possible to use a pulley ratio considerably beyond the ratio limit imposed by good engineering practice upon an open drive.

In the installation illustrated the pulley ratio is 1½:10. If laid out as an open drive, good practice would have limited the ratio to 1:5. A lower speed motor would have been necessary, at a considerably increased initial cost. Then, there would be the difference between the efficiencies of the low speed and high speed motors. This difference is small, it is true, but when extended over years of operation it runs into money. This Lenix is saving that money for its owner.

Pulley ratios as high as 1:15 have been used with the Lenix Drive.

The Lenix is not an idler. It is a "belt wrapper," scientifically applied to belt drives for the purpose of increasing the arc of contact, eliminating belt slippage and improving the general efficiency of the drive.

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Where Tradition Is Still a Handicap

(*Continued from page* 25)

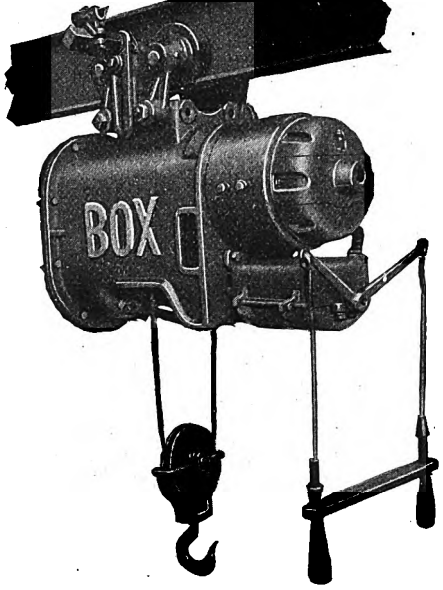
Even for those who have never handled six or seven wet brick, weighing from 30 to 35 pounds, it is easy to imagine the degree of physical effort a man must exert to do this work when the machine is running at capacity. Modern machines push a mold of nine brick out on a table, thump it and push the brick onto a pallet or tray, which is then easily slid off the table by a workman, and delivered to a conveyor at his side to be transported to the drying shed.

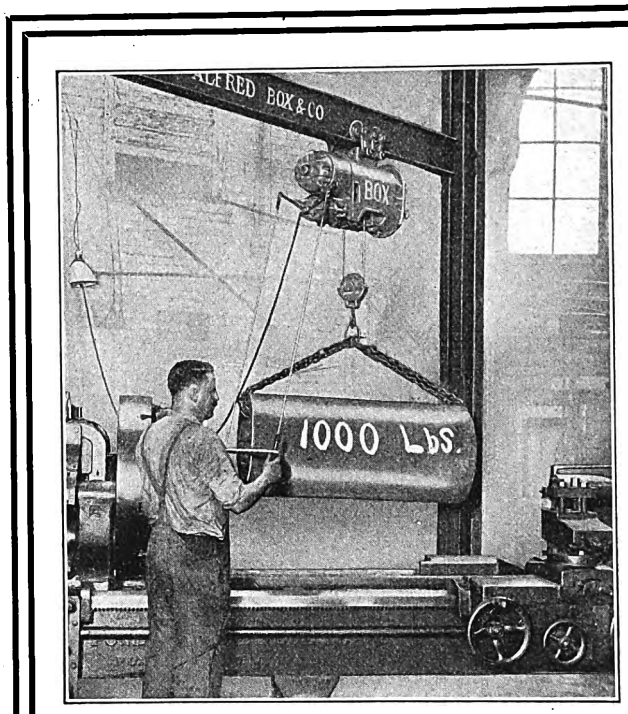
The next step in the process of manufacture is drying. Formerly this was done in the open air, relying entirely upon the sun and wind. The rows of brick, after being hacked up, as shown in one of the illustrations, were given a moderate degree of protection from rain by a roofing of boards laid along the top. A better plan than this has been in common use and consists in having sheds, open at the sides, in which rows of shelves were built on which the pallets of brick to be dried were placed. Even this system was largely dependent upon fair weather for successful drying, and of course afforded no protection when freezing weather set in. Drying houses, or dryers, offer the best solution to the problem and render brick manufacture independent of atmospheric conditions, making it possible to make brick throughout the year in those parts of the country where it had always been a strictly seasonal operation. With favorable weather, brick usually require from four to six days to become dry enough to put in a kiln. With a dryer, the same result can be attained in from ten to fourteen hours. The dryer is a long, one-story building containing shelves or racks on which the pallets of brick are placed. When heated by steam, the pipes constitute shelves for the pallets, steam circulates through them and the heat quickly dries out the water in the brick. In some dryers, flues are built into the floor and frequent openings are provided so that warm air or waste gases from the kilns can be forced through by a fan and thus effect drying. The dryer has ventilators in the roof to allow excess moisture to escape and between the rows of shelves there is a track on which small cars, carrying brick from the machine, are pushed in. In other cases, a conveyor takes the brick from the brick machine and passes completely through the drying house, where men unload the pallets as they arrive and place them on shelves.

In a steam-heated dryer, the brick are subjected during the drying process to a temperature of from 200 to 220 degrees F., depending upon whether exhaust or live steam is used. With a hot air system, practically the same temperature is maintained, as too rapid drying, due to a greater degree of heat than this, causes the clay to swell, crack and crumble.

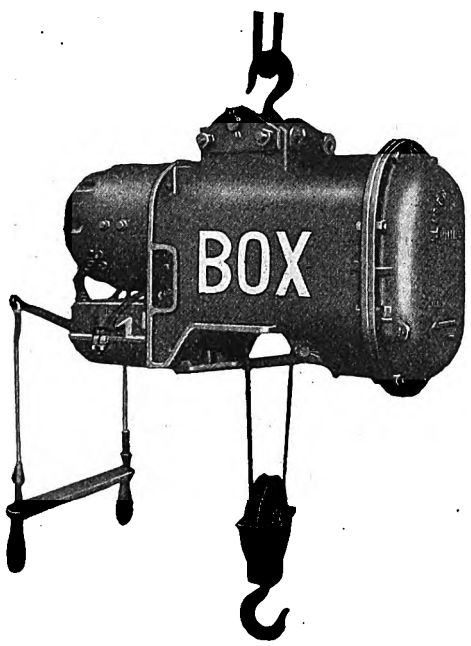
Burning, or firing, is the most difficult part of the process of brick making, for upon its

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roper management rests the ustification of all the labor and xpense of the preceding pro- esses. The strength and use- ulness of the brick depend argely, if not entirely, upon the egree of heat to which they are ubjected, as well as upon the anner and uniformity with hich the heat is applied. The ction of heat on the clay causes hemical decompositions and ecombinations that change its hysical characteristics. Clays n general are regarded by hemists as consisting mainly of luminosilicic acid, sand and ertain fusible minerals, carbon- tes of calcium and magnesium, xide of iron, and a small quan- ity of organic matter. They ontain also a certain amount f water, chemically combined, nd when subjected to the heat f a kiln, this water is driven ff in the form of vapor, or white smoke," as the burners all it.

The decomposition of the fusi- le minerals goes on as the heat ncreases, and when tempera- ures higher than 900 deg. F. re attained, the fusible con- tituents of the clay are oxid- zed, the sand is fused, and the whole mass becomes substan- ially a silicate of alumina, lime nd iron. The color of the fin- shed brick depends upon the nature of the clay used, as well s upon whether there is a de- ficiency or an excess of air in he kiln. Skill and experience re essential in the successful peration of a brick kiln and a eavy responsibility rests upon he boss who supervises the fir- ng. He must know how hot to et the kiln, how rapidly to in- rease the heat, and how long o maintain it.

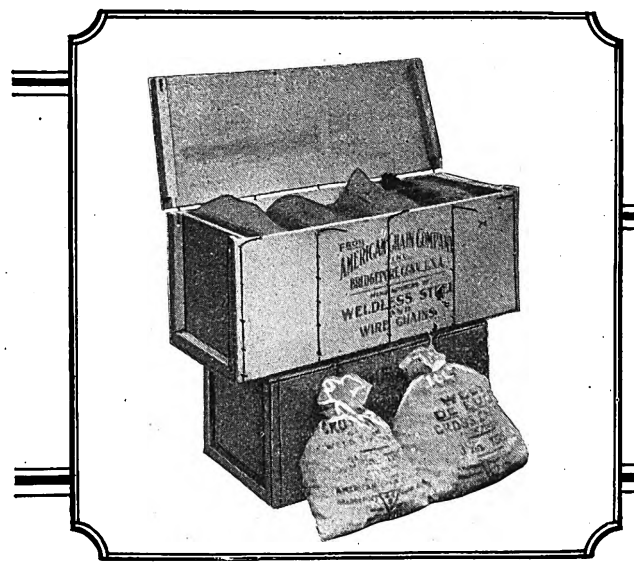
Kilns are usually of one or the ther of two distinct types: up raft and down draft. The for- ner is built by piling up the rick with spaces between for eat circulation, and building hem at the bottom into long, ow tunnels or "arches" in which he fires are kindled. The pile s carried up to a height of 18 r 20 feet and contains 30,000 r 40,000 brick. The outside is uilt up of under-burned or soft rick and plastered over with nud in order to close all cracks luring firing. The ends of the rches have cast iron doors hrough which the fuel is intro- luced and through openings in which the draft on the fire can e regulated.

The down-draft type of kiln is built of cylindrical shape, or sometimes rectangular, roofed over with brick and lined with brick checker work. In some districts, these kilns are used exclusively, as they are reputed to give a more uniform degree of heat and a larger proportion of marketable product.

For fuel, wood was formerly universally employed, but its rapidly increasing scarcity has forced brick makers to adopt coal, both anthracite and bitumi- nous, and to a limited extent, oil. From five to six days are required to burn a kiln of brick. When sufficiently cool to be handled, they are taken down and loaded for shipment.

Even with the exercise of the utmost care in putting up and firing a kiln of brick, there is always a certain percentage of loss due to uneven distribution of the heat; the result of this being that some brick, especially those in the arches nearest the fire, are over-burned, while oth- ers are under-burned, spongy and pale in color. Arch brick are excessively hard and very brittle; and while excellent for use in fire-resistent construc-

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Above is shown how automobile tire chains are shipped. The chains are put in sacks and then packed in Pioneers.

The illustration below shows how heavy chains, wound on spools, are shipped in Pioneer Wirebound Boxes



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tion, lack the compressive strength needed to sustain the load in a tall building. The soft, under-burned brick are in disfavor for buildings, as they are greatly affected by dampness and go to pieces quickly if exposed to fire.

The temperature in a brick kiln ranges between 1650 and 2280 deg. F., and much depends upon its ascertainment and regulation. While millions of good brick have been turned out of kilns in which the degree of heat was determined solely by the skilled judgment of the boss burner, modern requirements call for the exact indication of temperature and a continuous record of it, without depending on one man's skill.

A fair degree of accuracy in the determination of temperature can be obtained by the use of Seger cones, made of prepared clay so combined with other materials that they will soften and disintegrate at a certain temperature. Several such cones, each of such composition that they soften at a definite degree of heat, are put in the kiln, one to melt at say 1600, another 1900, another 2150 degrees, and so on. The burner watches through a peep hole in the side of the kiln, and as each cone softens and crumbles away, he knows that the corresponding temperature has been reached.

Greater accuracy than can be attained by this method, however, is often required, and in the most progressive brick plants, thermoelectric pyrometers are extensively used. These instruments not only give exact indications of temperature, but can be arranged to record the temperature automatically and continuously during the entire period of firing.

This information has a distinct money value to the manager of a brick plant, because experience has demonstrated that where the heat of a kiln is known with exactness, there is a larger percentage of good marketable brick in the output. With a pyrometer properly connected, a boss burner can see at once how hot his brick are getting and can also determine this for any one of a number of kilns that may be burning simultaneously. A recording pyrometer gives a graphic record of how well the burners have maintained their fires during the night or during any period. By thus enabling the heat to be more closely regulated, a shorter burning period can be secured and in consequence, a considerable saving of fuel. Some makers have reported that they were able to burn brick satisfactorily in three days when using pyrometers, compared with a five-day burn when they were unable to determine temperatures with exactness.

The pyrometers in general use are made of platinum with a platinum-iridium alloy; or of a nickel-copper alloy with copper, iron or nickel-chromium. The thermocouple made of such metals is enclosed in a porcelain tube which in turn is placed inside a heavy, fire clay tube sealed into the roof of the kiln, and conducting wires are run to an indicating galvanometer, whose scale is calibrated to read in deg. F.

Throughout the process of brick manufacture, machinery has gradually superseded hand labor for many operations; and while it is impossible entirely to substitute machines for men, yet in the best equipped plants the number of employees per thousand brick produced is much

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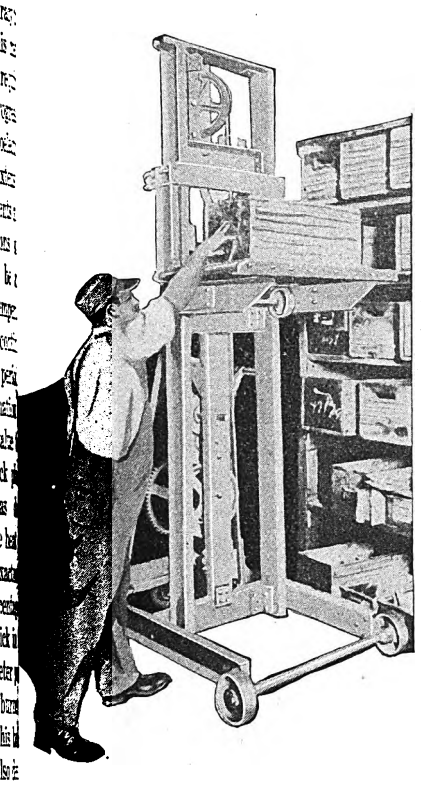
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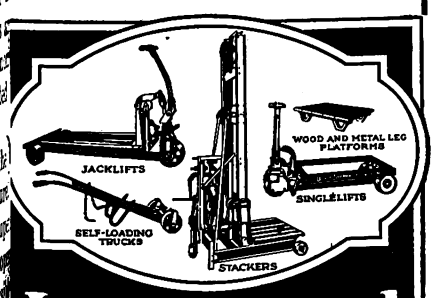
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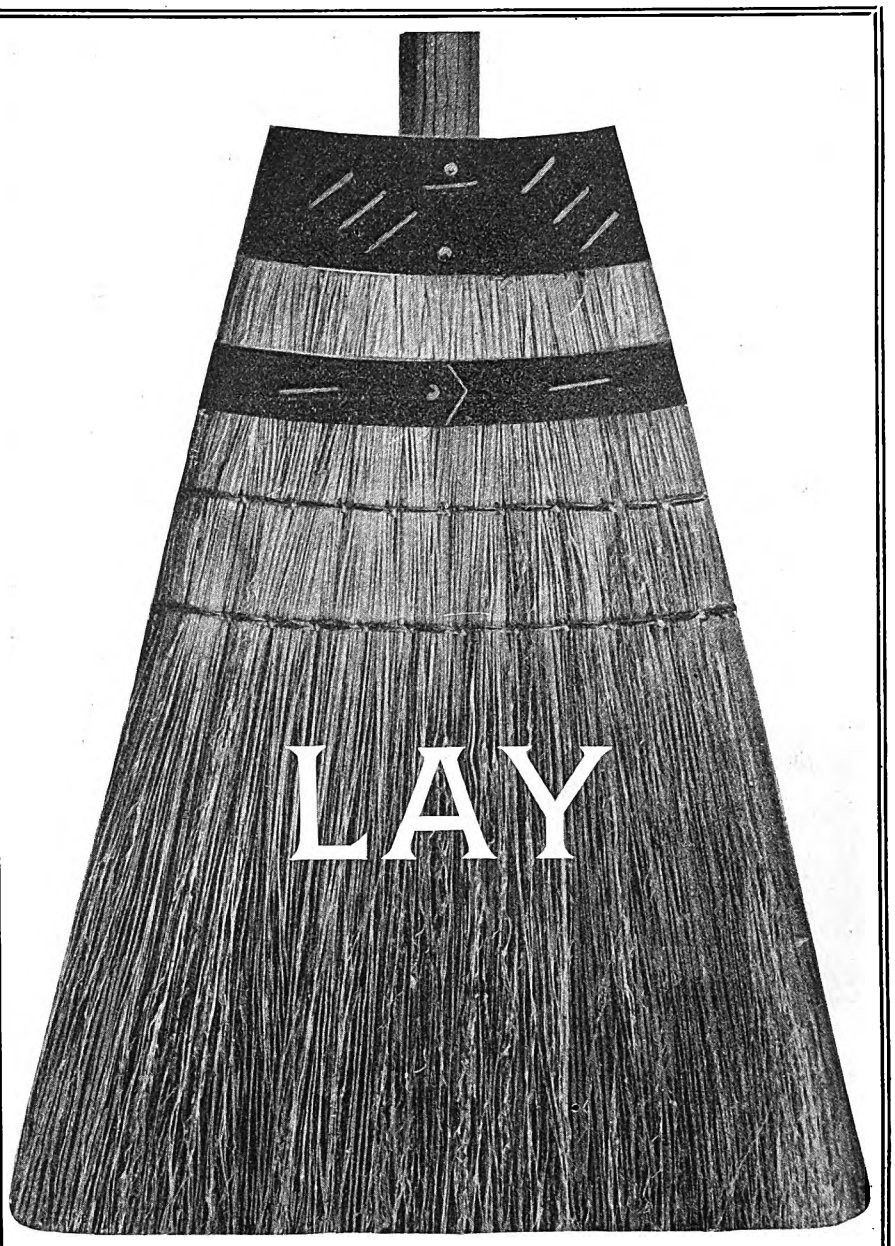
smaller than formerly. The mining or digging of the clay is done by means of a steam shovel or some other form of mechanical excavator, which dumps its load into small cars of from one to three cubic yards capacity. A train of such cars is hauled to the mixing pits by an electric trolley or storage battery locomotive. At one plant visited by the writer, an electric locomotive, taking current from two trolley wires, and a four-cylinder, gasoline locomotive were doing equal work hauling clay cars for a distance of one-half mile to the mixing pits.

Many kinds of mill are in use for crushing, pulverizing, and mixing the clay, sand and coal-dust in the course of their preparation for the brick machine, but such mixers receive their clay directly from the cars, and in suitable proportions also the other ingredients are dumped; often motor trucks with dumping bodies being employed. Where there is a sand bank on the property, and in many cases there is, the sand is dug out, elevated to a screen, poured into a bin and delivered to a truck without any manual labor whatever.

Manual labor was formerly employed to load the molded brick on wheel barrows and dump them out on the floor of the yard to dry. Later on they were "hacked" up in rows about four feet high, the brick being set up with spaces between adjacent brick to allow for circulation of air.

The usual proportion, with the machinery and methods of twenty-five years ago, was one man per 1,000 brick per day. Thus a yard producing 40,000 brick daily employed about 40 men. The ratio is better now, although the men will not handle as many brick as formerly, and their pay is more than double what it was at the time referred to. Better methods and improved machinery have, in spite of this, increased the output per man.

The ingredients having been thoroughly mixed are next transferred on a belt conveyor to a hopper in which they are soaked with water and from which they drop into a pug mill. This is a trough or box, usually constituting an integral part of the brick machine, and having a shaft running through it on which is a series of vanes or knives that mix and push the mass of clay from the hopper



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end to the other, where it is forced into the brick machine, which molds it to shape. Formerly it was necessary to do a great deal of hand shoveling in the process of mixing and delivering to the pug mill. In one type of machine, the pug mill is combined with what is called an auger machine, the curved blades of which force the wet material through a die, which delivers a column of clay on the table of a cutting machine equipped with a number of taut, parallel wires that cut the clay into bricks. From the table of this machine the bricks are transferred to the dryer.

The advantage of improved machinery and methods is this: that manual labor, even though men work more slowly than formerly, is rendered more efficient through the employment of machinery. For example: at one brick yard the managers report that since the introduction of modern equipment, six men do more work, in terms of brick output, than thirty men formerly accomplished by the crude machinery then in use.

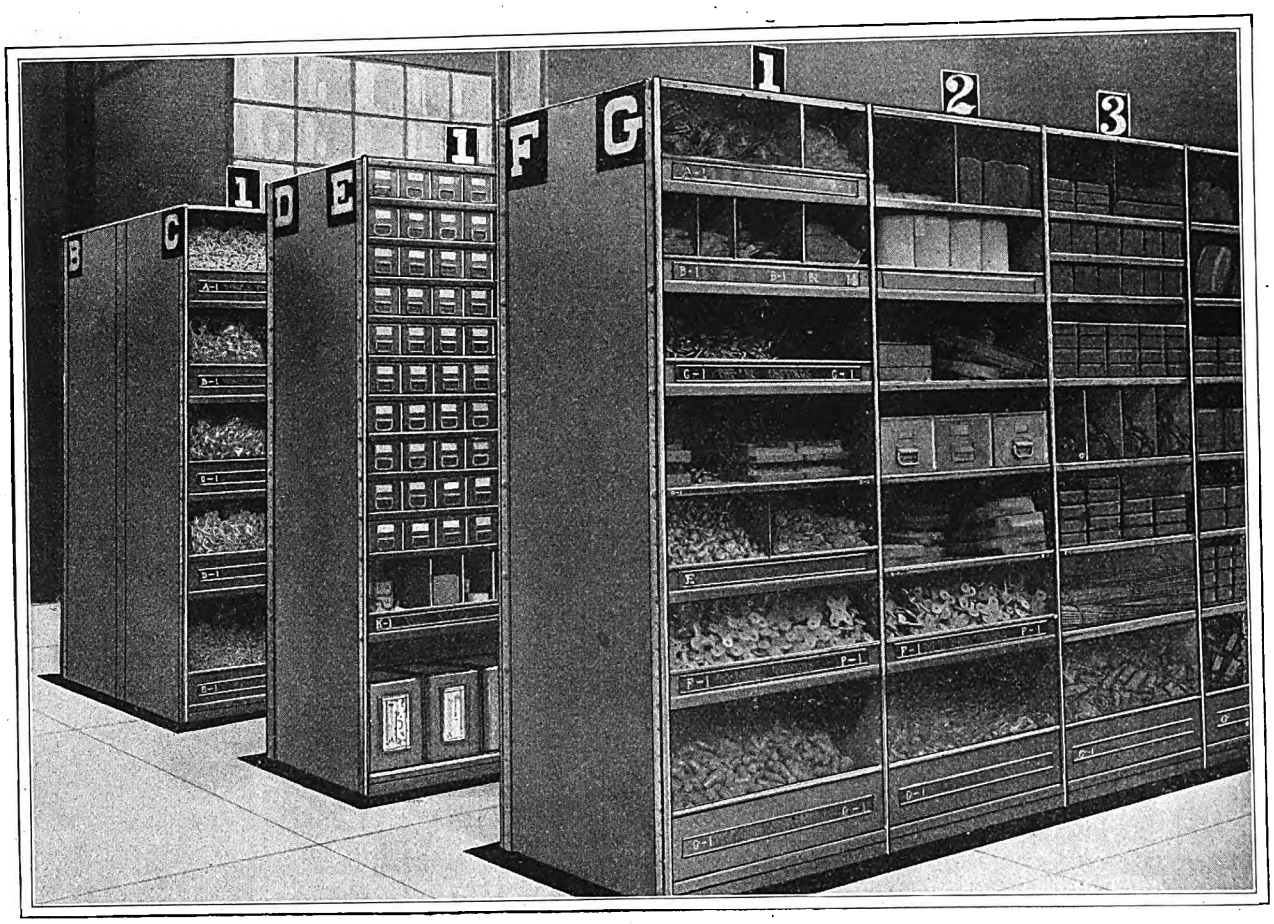
The installation of a conveyor and the addition of improved mixers and feeders for the clay, and machine handling at the kilns eliminated the employment of eleven men.

At another plant, the installation of a conveyor to take brick from the machines to the dryer did away with five truckers.

One brick company rearranged its plant and installed modern machinery at an outlay of several hundred thousand dollars. Fewer men are now required, a saving in wages of $72,000 a year has been effected, and *more brick* are turned out.

An important step in the standardization of building materials with a view to reduction of costs has been taken through an investigation by the United States Department of Commerce on the various sizes of brick produced by different manufacturers. The inquiry showed that 167 brick making plants throughout the United States were manufacturing 39 different sizes of rough brick during 1922; and that 141 plants made smooth brick in 36 varieties. For the purpose of simplifying this condition and of reducing the number of superfluous sizes, a committee recommended that only two sizes be made; thus eliminating 38 rough and 35 smooth brick varieties. It was estimated that more than 80 per cent. of the brick made in the United States is of the average dimensions covered by the recommendation. The committee, in addition to representatives of the Division of Simplified Practice of the Department of Commerce, included members of the United States Chamber of Commerce, the American Face Brick Association, the American Institute of Architects and the Supervising Architect's Office of the Treasury Department.

Too little account is taken of the ultimate effects which the proposed railroad rate cuts would have upon the railroad owners, upon other shippers and consumers, and upon the farmers themselves. The question of proper freight rates for farm products involves the whole rate structure. If these rates are to be lowered, producers of other basic commodities will find occasion to demand similar revisions.—*The Guaranty Survey.*



Simplifying a Complicated Stores Problem

In this up-to-date stockroom two men fill several hundred orders per day from seven Lyon Standard Steel Racks. These racks are all 8 feet high, 12 feet long and 3 feet deep.

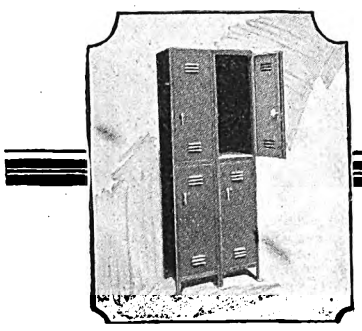
In two racks dividing backs separate the shelves, giving 18 inch shelves on both sides. Bin fronts are used where the stock keeper stores quantities of small loose parts. The boxes used in one rack are subdivided so that five different items are kept completely separated in each box.

These racks carry heavy loads and a great variety of parts. This is a fair example of how a complicated stockroom problem can be simplified and confined to a comparatively small space.

With no obligation, you may have a Lyon Engineer call and study your storage, stock or tool room needs. His advice will cost you nothing and, because of our experience with storage methods in many industries, may be worth a great deal to you.

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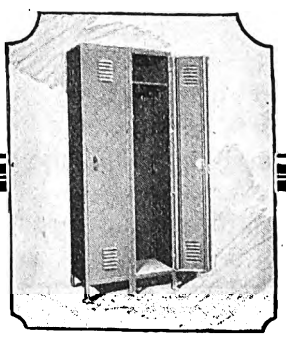


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Making Seattle A World Port

(*Continued from page 26*)

in 1916, the feasibility of the proposition had been recognized and considered both by Seattle's citizens and by the War and the Navy Departments. Those pioneers who were able to visualize the great lumber mills and other industries which now operate day and night along the shores of Lake Union, had for years fought valiantly to achieve the success of their plans. Barring emergencies, however, improvements of a far reaching character are usually secured only after the overcoming of considerable opposition, much of which is usually offered in good faith. And this case was no exception.

Groups of land owners and private interests of various kinds endeavored to block the progress of the scheme. They opposed it because in equalizing the level of the two lakes by means of the connecting canal, Lake Washington would be lowered about eight feet, and dire results were predicted. They derided the idea of opening Lake Union to industry—it was unnecessary, they thought, in view of Seattle's admirable salt water tidal harbor on Puget Sound. Their objections are cited only as a sidelight upon the facts as to the commerce which has actually developed in the seven years since the waterway was opened.

The locks themselves are massively constructed of reinforced concrete. The longer of the two is 825 feet in total length, 80 feet wide inside and 56 feet high. At the base its walls are more than 50 feet thick. Three sets of electrically operated steel gates serve to divide this lock into two compartments, 475 feet and 350 feet long respectively.

The smaller lock adjoining is intended to accommodate light craft only. Its total length is 160 feet. The dam is of the fixed type, with a movable crest composed of a series of segmental steel gates which permit the level of the lakes to be held at an even elevation, viz., twenty one feet above low tide. The lift of the locks is twenty six feet, and the depth of water over the sills is such that with the exception of dreadnaughts, practically all of the Navy's vessels could, if necessary, be passed through into an impregnable harbor. The total distance to Lake Washington's deep water from Puget Sound is about eight and a half miles, a part of which lies through the deep water of Lake Union.

Facts shown below, relative to the volume and the value of the cargoes which have passed through the locks during the few years that they have been operated are illuminating. The statistics, prepared by the War Department, show that the principal commodities are logs, lumber, fuel oil, sand, gravel, paper, coal and fish.

The values as shown include that of the floated timber. In 1920 this item alone amounted to $8,223,800.

TRAFFIC THROUGH THE LOCKS
In Tons of 2,000 lbs.

Year	Tons	Value	Floated Timber Tons
1917	650,300	$ 4,254,200	543,000
1918	765,400	6,521,100	554,000
1919	1,020,700	9,520,400	774,000
1920	1,368,900	15,567,800	918,700
1921	1,503,766	14,777,343	826,887

In the face of such figures it can not be denied that the construction of the improve-



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ment has opened up great possibilities. Yet even with such a splendid showing, it may be said that they have scarcely been touched. For as yet the industrial development has been confined almost entirely to Lake Union. Lake Washington's wooded shores have not yet been provided with the docks and other shipping facilities necessary for commerce. They are therefore almost untouched by the hands of trade, and are dotted with residences commanding attractive views of the locality.

A distinct advantage to industrial plants located along these fresh water lakes lies in the freedom from attacks of the teredo upon pile foundations. This troublesome little pest, found only in salt water, creates havoc with such structures of timber as are exposed to its ravages. Marine growths, such as barnacles, which attach themselves to hulls plying in salt water, drop off after a short period of anchorage in Seattle's lakes. Although they carry much of the paint with them, the expense of scraping the bottoms is almost eliminated. Another feature—that of the constantly stable lake level, is of advantage principally to smaller craft, not provided with derricks for hoisting cargoes; equipment which is of course essential in a tidal harbor.

It is instructive and interesting to watch the huge lock gates at the Lake Union entrance to the canal slowly and noiselessly close at the touch of the attendant's hand upon the electric controller. Perhaps a tug boat, towing a raft of logs, is passing through. Or it may be a great freighter, laden with a cargo for a distant Oriental port. Again, the vessel may be a luxurious pleasure yacht, headed for some beautiful island camp in the Puget Sound region. They all pass either way without charge, for Uncle Sam operates his locks with a generous spirit, although at a cost to him of more than $71,000 a year.

When the craft has been safely enclosed within the chamber, unseen valves open, and the water rushes out through channels beneath the structure, boiling up in a mad whirl below the locks, as it mingles with the brine of Puget Sound. Swiftly the vessel is lowered to the tidal level. In a few minutes the outlet gates are opened, and the tug, the ocean tramp, the schooner or whatever it may be, proceeds upon its way.

Prediction as to the extent to which commercial development will advance during the next decade as a result of the opportunities presented by these works, is a difficult matter. Certainly Seattle has not been slow to realize their benefits, and having an ambitious spirit which would develop this city into the "New York of the Pacific," there is no doubt that progress of a substantial character will be achieved.

"The extent to which Germany has so far succeeded in keeping her industrial machine intact is due in no small part to the elaborate scale on which her standardization work is performed," it is stated in the bulletin, which was prepared by Dr. P. G. Agnew, secretary of the American Engineering Standards Committee, who recently returned from Europe, where for two months he made a study of the standardization movement and the manner in which European developments in this direction are likely to affect American industry.

WORTHINGTON

This Compressor Saves $775 a Year

The air compressor shown is a Unaflow steam cylinder machine having a capacity of 1,500 cubic feet of air per minute. This compressor under usual conditions will save 4,980 pounds of coal in an eight-hour day, as compared with a Meyer Gear Compressor—a saving which amounts to $775.00 in a year.

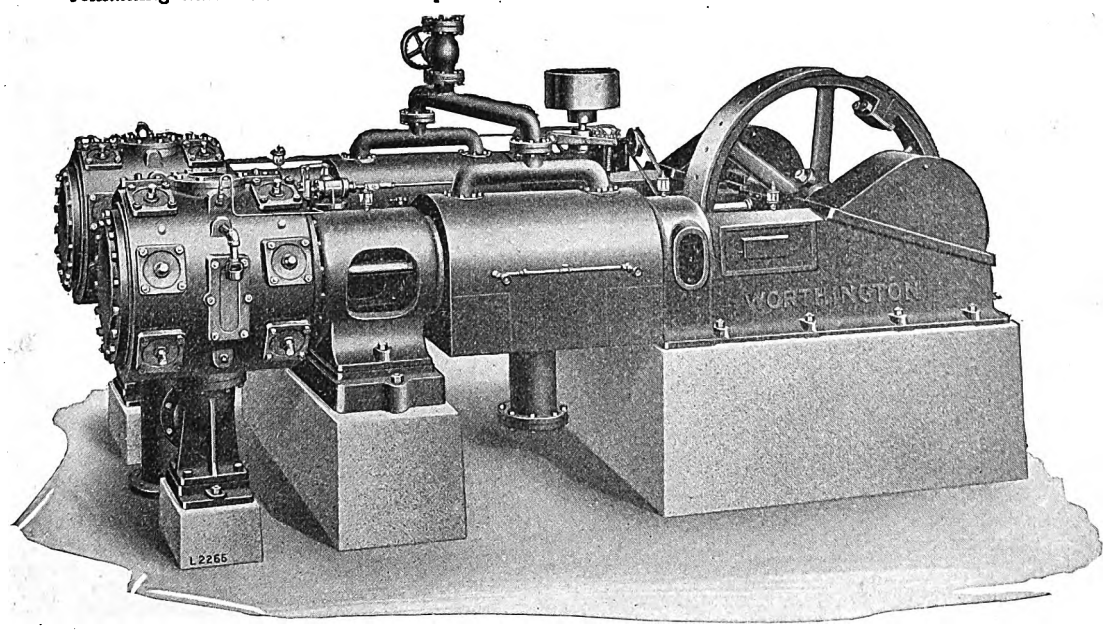
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THE UNAFLOW ENGINE

Another contributing reason for the exceptionally high economy of the Unaflow compressor is high compression. As the steam, expanding away from the cylinder head, rushes out through the central exhaust port, it carries practically all the wet steam out through the exhaust. When the exhaust port is closed, by the returning piston, the remaining steam, which is comparatively free from moisture, due to the effect of the steam jackets, is compressed to practically initial pressure.

This adiabatic compression of the remaining exhaust results in a compression temperature actually above the initial steam temperature. The live steam, upon entering the cylinder, thus comes into contact with steam filling the clearance at practically its own pressure, and at a temperature higher than its own. Furthermore, the surrounding metal surfaces are likewise at initial steam temperature.

As a result, cylinder condensation is practically eliminated, and a performance is obtained that is most exceptional. Worthington Unaflow Compressors lead the market by their remarkable economy and smooth operating qualities.



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Research and the Modern Industrial Laboratory

(*Continued from page* 15)

causes for discouragement. I know of large industrial laboratories started since the war which have been discontinued. I know of sections of the National Research Council where the only accomplishment has been to hold a committee meeting and print the minutes. Much of the research work undertaken at universities has been characterized by the Carnegie Foundation as "pseudoresearch." I have seen one annual report of the research section of one large engineering college which described some twenty problems on which the students were engaged, and not one of those problems was what I would consider true research, nor of value in teaching research methods.

These things may result in discrediting research and in starting a backward swing to pre-war conditions. Should that swing occur, it would be a long and difficult task, without the war stimulus, to get back again to where we now are.

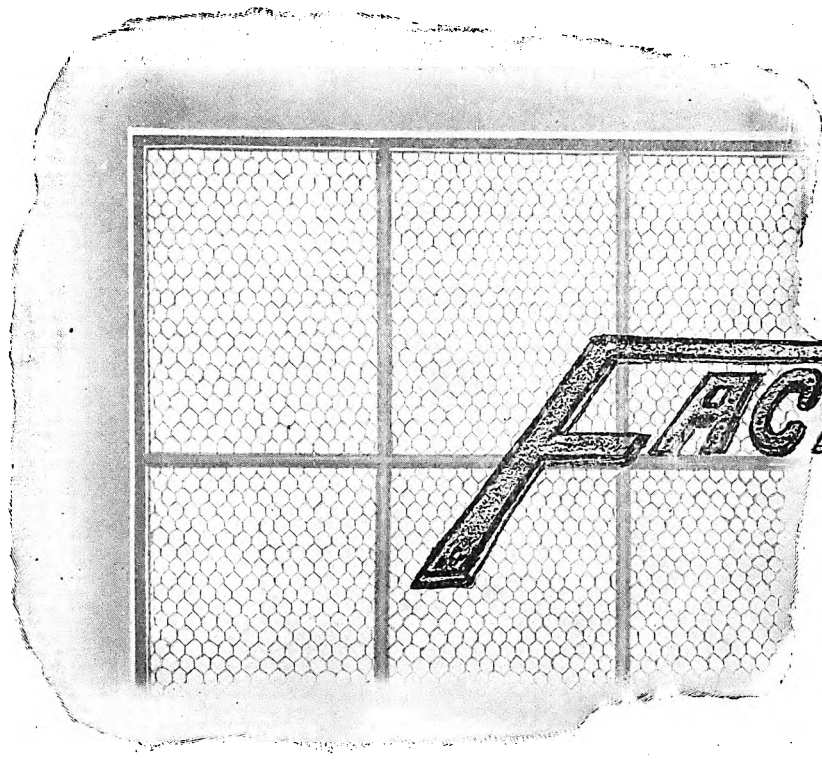
The extent of that loss could be testified to by anyone in the General Electric Company who knows what research has done for that company. Whole factories and larger sections of other factories are engaged exclusively in producing devices or materials that originated in the Research Laboratory. Every department of the company has profited in the way of improved devices or reduced cost by the work of the laboratory.

Established twenty-two years ago, the General Electric Research Laboratory, begun in a small way, has expanded until it is now one of the most complete and most noted institutions of the kind. The Research Laboratory occupies the major portion of five floors of Building No. 5, which is located at the entrance to the Schenectady plant. The floor space utilized, 89,336 square feet, is divided into 132 rooms.

The basement of the building is used to provide facilities which are in general demand, such as electrical power, vacuum, liquid air, motors, transformers, and rheostats. Power is distributed at 125-250 volts, D. C., and 550-240-120 volts, A. C., from 154 trunk lines, and also by separate lines from twenty-four motor generators. The distributing pipe lines also have service valves in this basement.

The pipes and wires are arranged in horizontal ducts large enough for workmen to make alterations and repairs. These ducts are directly over the corridors. Ample head-room provided throughout the building makes this duct construction possible. Vertical ducts connect these horizontal ducts to the basement. This system requires about five miles of pipe, and forty miles of insulated copper cable. The wiring arrangement will allow each cable to be withdrawn and replaced without undue interference with the others.

The vacuum pipe line has been given special care. Four-inch standard pipe was used, on which threads were carefully



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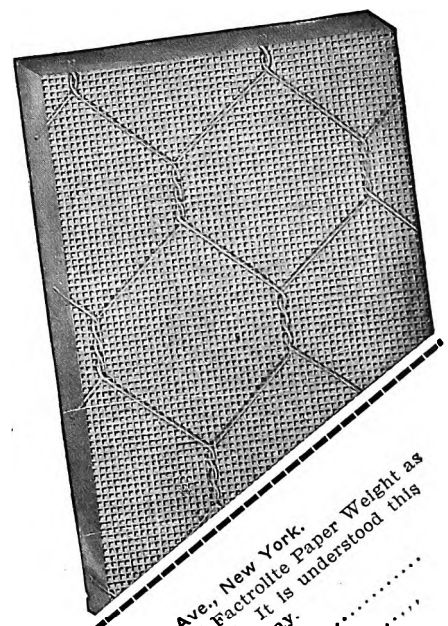
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Each work room has available city water, river water, illuminating gas, compressed air, vacuum, high pressure hydrogen, low pressure hydrogen, oxygen, live steam, low pressure steam, vacuum cleaning, and distilled water. One or two terminal switchboards are also provided, from which a maximum of 250 kw. can be drawn, or connections made to any other room, or to basement distribution board, and from there to other laboratories in the plant. Experiments requiring 20,000 amperes, 200,000 volts, temperatures of 3,000° C. or —200° C., and highly reducing or oxidizing atmospheres, are possible from standard equipment.

On the first floor of the laboratory are offices, the library of 3,000 volumes, and six experimental rooms used for X-ray investigations. The X-ray equipment comprises a Victor high voltage machine capable of giving 30 milliamperes at 280,000 volts, a Symmetric machine of approximately the same voltage, but lower current capacity; a Snook interrupterless machine of 100,000 volts, 100 milliamperes; two Waite & Bartlett machines of the same rating; a constant potential continuous current outfit for 200,000 volts, 10 milliamperes; an oil-immersed dental outfit for 40,000 volts, 10 milliamperes; a Ritter dentist's unit; a Victor radiographic table; a complete tube exhaust system; a photographic dark room, and miscellaneous equipment, such as 25 cm. sphere gap, 12½ cm. sphere gap, ionization chamber, spectrometer, etc.

Connected to the rear of the building there is a one-story section of 4,000 square feet, with 23 foot head room, which is at present used as a metal working department. Rolling mills ranging from 10 in. by 12 in. to 2 in. by 4 in. are perhaps the most impressive pieces in this section, but there are also 100-ton hydraulic presses; tungsten and molybdenum treating equipment, several swaging machines, wire drawing apparatus, dozens of high temperature hydrogen furnaces; ball mill, sifting apparatus, and vacuum furnaces.

Several years ago this section was used as a small experiment porcelain plant. It has also been used for steam turbine and boiler corrosion test. Two small cranes are used to handle the heavier pieces.

A tile roof on this section provides space for outdoor experiments.

A large portion of the second floor is devoted to model and apparatus construction, and contains a machine shop, carpenter shop, and transformer and coil department.

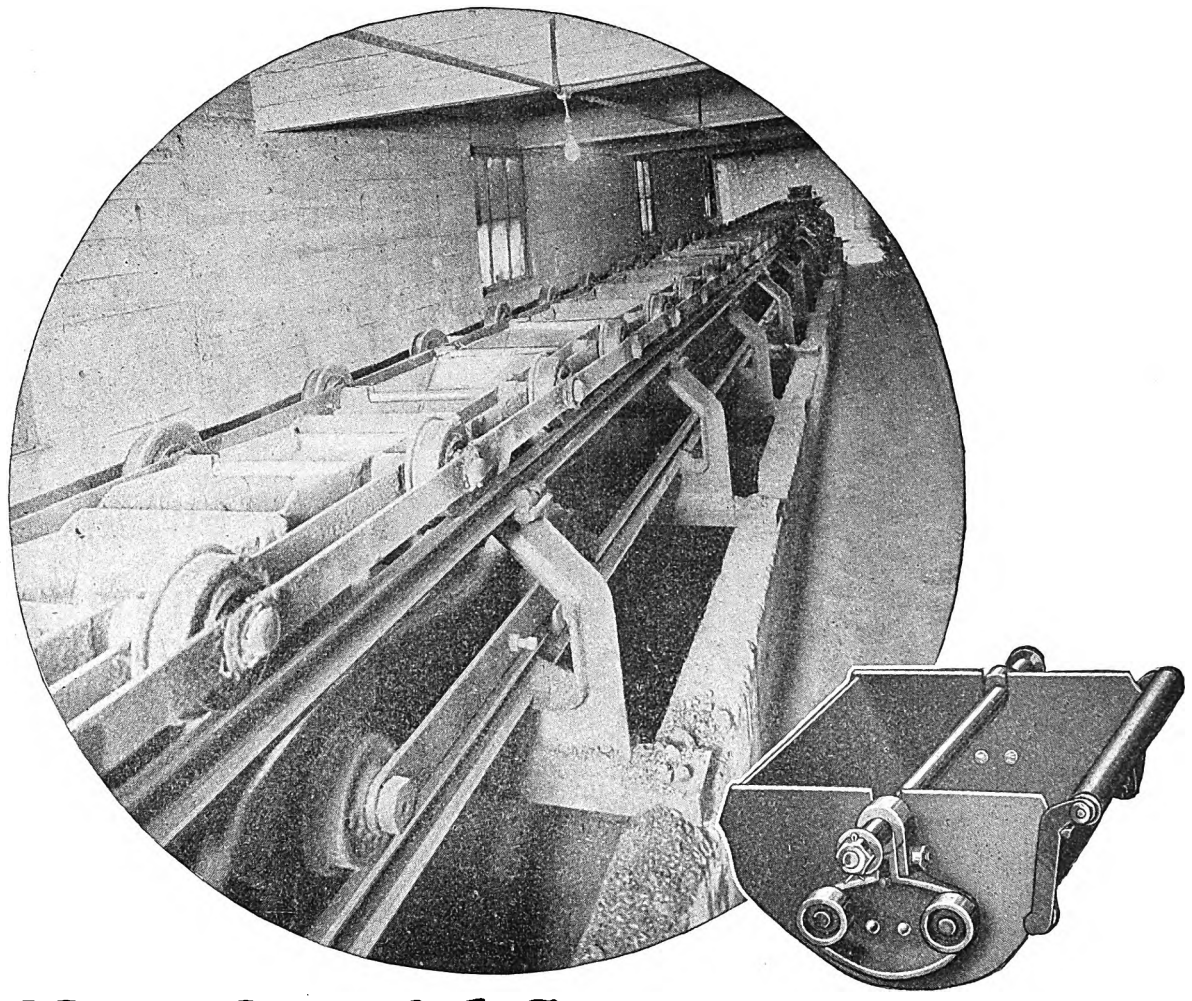
The machine shop is equipped with a wide variety of tools, including lathes, millers, shapers, drill presses, disc grinders, surface grinders, external and internal grinders, precision lathes, and diamond die drilling and polishing machines. It is seldom necessary to call on the larger shops for facilities.

The carpenter shop is equipped as far as possible with machines, but its chief function is to provide a high grade of hand work on wood, or similar material.

The transformer department furnishes special electrical apparatus which is not readily available from the factory. It also utilizes untried methods of winding and insulation, thus aiding the search for the best.

The analytical laboratory is

(*Continued on page 72*)



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THE Perkins Pivoted Bucket Carrier At Work—discharging a continuous stream of coal on the upper run and ashes on the lower run of conveyor—at a tremendous saving of man power—

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The Perkins Pivoted Bucket Carrier handles both coal and ashes with low operating and maintenance charges. It does the work mechanically releasing labor help for more profitable work.

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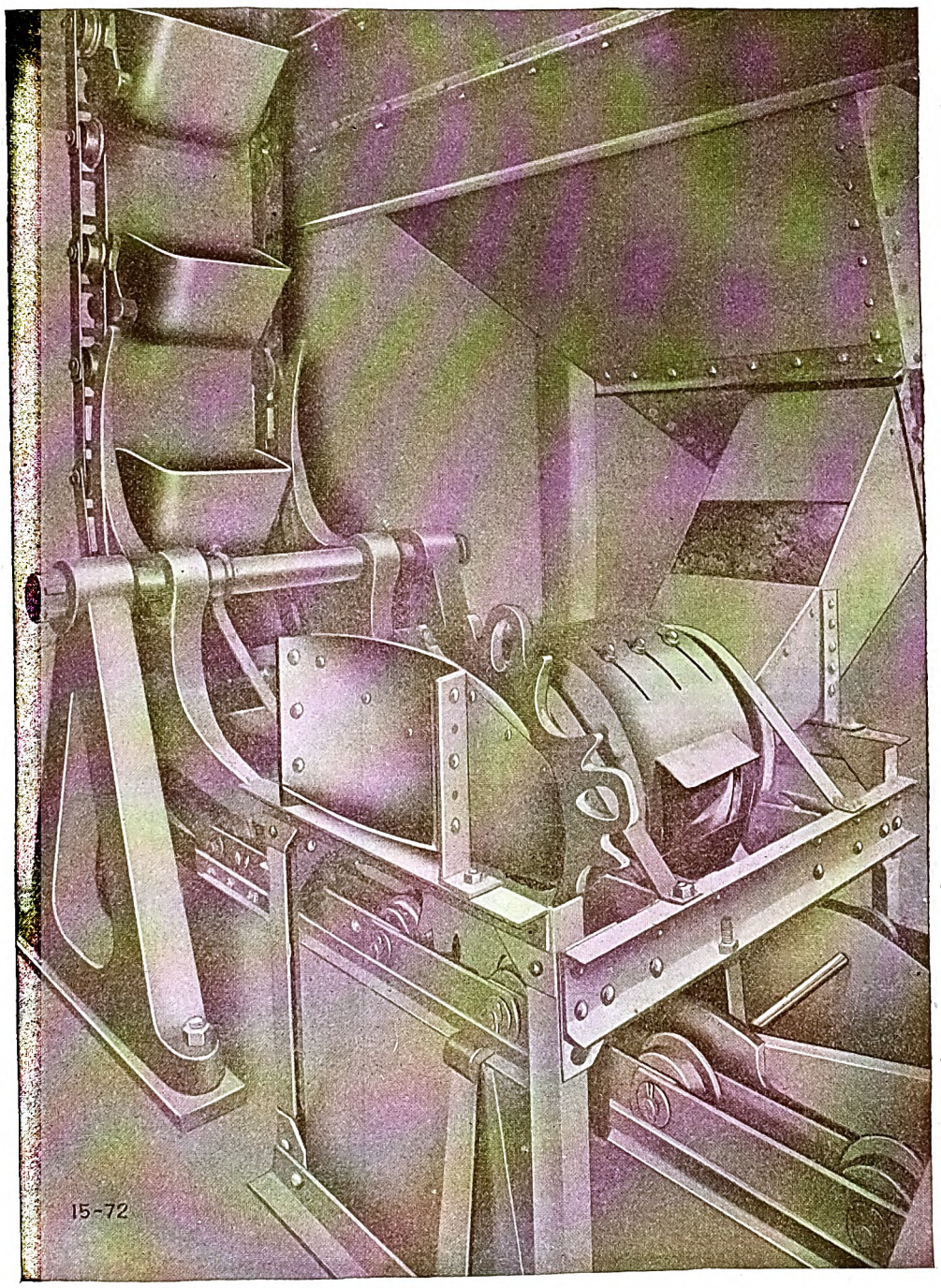
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All industrial executives realize that unless their business is so conducted that a profit accrues, their activities are doomed to failure. No project whatsoever is exempt.

Yet what is done to insure that profit? The answer may be,—and generally is—"We effect economies wherever and whenever possible!" But this usually applies broadly to the business as a whole; specific cases are often overlooked; such as, for instance, coal and ashes handling and rehandling.

Inadequate methods for performing this function is an expensive burden. These may consist of obsolete or unsuitable mechanical devices that are forever getting out of order, requiring constant attention and repairs, causing expensive shut-downs and loss of production; or perhaps the old back-breaking, muscle-straining, wheelbarrow system is in vogue. All, or any, of which add to the handicap imposed by the high cost of fuel and labor, before a pound of coal enters the furnace. Then, too, there is to be reckoned with, the removal of ashes.

Here, in the initial function of power generation, the executive can effect economies that will be reflected in the profit on his product, if he will but choose wisely in the selection of his coal and ash handling apparatus.

Hunt Coal, Ashes and Coke Handling Machinery has won the approbation of executives in every industry during the past half century because of its ruggedness, freedom from serious breakdowns, low upkeep and its ability to perform long and satisfactory service under the most severe conditions with the greatest economy.

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(*Continued from page 70*)

on the third floor. The work tables are covered with glazed roofing tile. There are two double hoods, a work table equipped for electrolytic work, and a draft-proof balance room. On this same floor the work on transformer steel and other alloys is conducted, the equipment comprising a set of small electric furnaces for making alloys, eight small electric muffle furnaces, two vacuum melting furnaces, three electric and two gas melting furnaces, potentiometers and Wheatstone bridges, a Burrows permeability apparatus, storage batteries, two photomicrography outfits, and chemical balances. There is also a metal testing room equipped with a 20,000-pound Olsen testing machine; Erickson tester, Brinnell machine, three fatigue machines, and two electric tool hardening furnaces. On the same floor is apparatus for testing motor and generator brushes, and for testing oil and bearing. There is also a high voltage rectifier equipment and water-cooled X-ray tube outfit for taking X-ray spectra to show the arrangement of atoms in crystalline materials. On the same floor is a room devoted to further improvements in "Water Japan," a non-inflammable japan developed in the laboratory, but now in production in the factory.

Work on lamps and vacuum tubes is done on the fourth floor, the laboratory for this purpose comprising a small but complete factory for the manufacture of lamps with a maximum capacity of about 100 lamps per day. There are four large and four smaller exhaust ovens of standard type, three special ovens for special exhaust, a Thomson welding machine, three sets of apparatus for making arced joints, three for pinched joints, two filament winding machines, an apparatus for making pure nitrogen from tank nitrogen, and a similar apparatus for purifying argon, and a gas density balance. For testing lamps there are three Lummer-Brodhun prism photometers, two portable photometers, one flicker photometer, one Lummer-Brodhun precision photometer, and an optical pyrometer for filament temperatures calibrated up to the melting point of tungsten, 3,450 degrees K., a storage battery, 30 amperes, 144 volts, is used for the photometric work, and two spheres, one 54 inches and the other 10 inches. The life test has a capacity of 60 kw., and facilities are provided for obtaining voltages from 0 to 250 in one-quarter volt steps. A voltage regulator maintains constant voltage on the busbars. Additional circuits are provided for "shop tests" of 120 volts A. C., and 125 and 250 volts D. C., and also an outdoor series circuit of 6.6 amperes equipped with compensators for the high current series lamps. There is also a life test rack with current regulator for street series lamps. Auxiliary testing apparatus provides for the determination of tensile strength, brittleness, and vapor pressure of filaments. Complete outfits are at hand for preparing and treating rods both in hydrogen and in vacuum, and apparatus for photomicrography.

A color booth for studying color values of glasses, apparatus for studying residual gases in vacuum lamps, and apparatus for photographing filaments while burning, are included in the equipment.

On the fourth floor is also the



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work on vacuum tubes for radio. One room is permanently equipped with circuits and instruments for quickly checking the characteristics of all standard types of tubes. Another room, part of which is entirely enclosed in metal screening, is used for special tests on receiving tubes. Still another is equipped for tests on transmitting tubes up to 20 kw. Two rooms, one equipped with exhaust ovens, are used for experimental work in developing new types of tubes. In one large room work is conducted on various problems relating to radio, such as the theory of selective antennae and loud-speaker design. A dark room is provided for investigations on photo-electric cells.

On the fifth floor part of the work relates to high power vacuum tubes and their applications. High voltage power transformers and large reactances and condensers are provided. One room is devoted to the study of vibrations and stresses in turbines and other machines. Here apparatus is provided for high speed photography capable of taking motion pictures with 1,500 exposures a second, or single exposures in one-millionth of a second. Other turbine investigations are also carried on in another room.

Also on the fifth floor is the work on insulations. Insulating varnishes of many varieties, all kinds of molded compounds, mineral insulations, enamel for wires, synthetic resins, and other materials are receiving constant study and improvement. Grinders, mixers, electric drying ovens, a hydraulic press, wire enamelling equipment, ventilated hoods, are part of the equipment for this work. There is a life test for vacuum tubes on the fifth floor, and also an assembly room for meetings and lectures.

Part of the work of the research laboratory is housed in smaller buildings. There is a furnace building equipped with various types of electric furnaces up to two tons capacity. Here the laboratory has for years made all the high speed steel used in the Schenectady Works. Other electric furnace products such as titanium carbide for magnetic arc electrodes, boron carbide for use as a deoxidizing flux in casting copper, heat-resisting alloys, and non-magnetic alloys, are or have been regularly produced. There such processes as the graphitizing of carbon brushes and the calorizing of steel have been carried on.

In another building is the work on purification and reduction of tungsten and molybdenum, the two metals used almost exclusively in the construction of X-ray and other vacuum tubes.

One of the primary purposes of the research laboratory is, of course, to glean from the field of science principles and ideas that industry may make of practical value to the world and the world's material work. Another is to seek the solution of problems in manufacturing processes, production and similar matters.

Conspicuous among its achievements in the first mentioned class is the X-ray apparatus devised by Dr. W. D. Coolidge, one of the assistant directors of the laboratory; the various electron tubes it originated, and the gas-filled incandescent lamp known as the Mazda "C" lamp, invented by Dr. I. Langmuir, the other assistant director. In the second are the discovery of the method for making tungsten

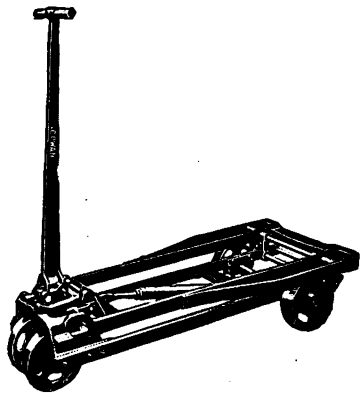
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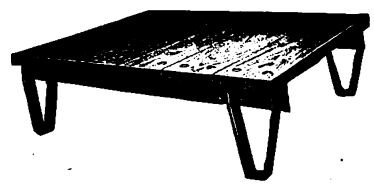
Many executives have unexpectedly found a surprising number of these "holes," through a casual stroll through the shop or warehouse.

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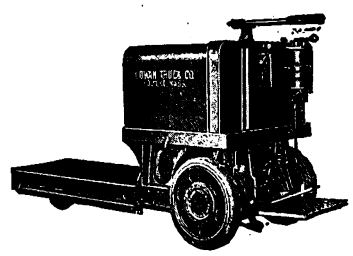
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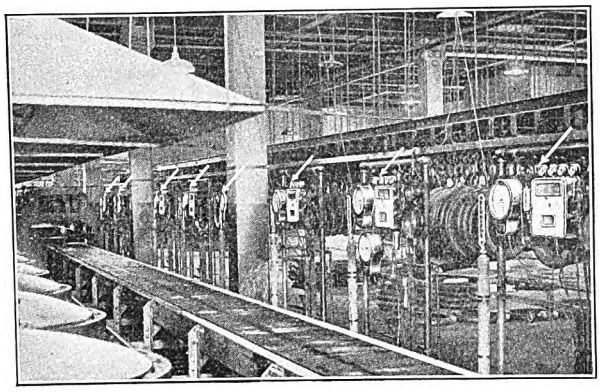
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ductile, with all the revolutionary effect it has had on the process of making incandescent lamps; the magnetite electrode, which alone has survived the competition of the Mazda "C" lamp in street lighting; the method of calorizing steel; the invention of Genelite, a self-lubricating material for bearings; "water japan," a japan without a solvent, the use of which involves no fire hazard; the tungar rectifier for battery charging; "sheath wire," with mineral insulation used in heating devices; the heat-resisting alloy "Calite"; and the Langmuir vacuum pump, which produces the highest known vacuum.

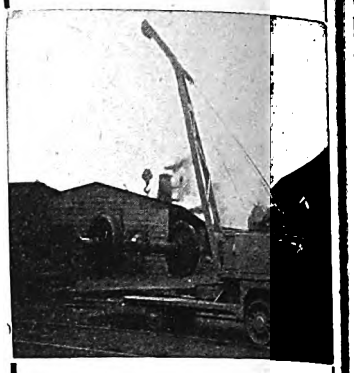
Thus every real addition to our knowledge, whether it is a fundamental discovery, revolutionizing scientific thought, like Thomson's discovery of the electron, or the explanation of a baffling phenomenon by the establishing of a new principle, like Langmuir's "space charge law," or learning how to do something before impossible, like the production of high vacuum, or the mechanical working of tungsten, leads almost invariably to new devices, new arts, new manufactures, and new comforts or conveniences for mankind, and these ultimate results are seldom foreseen while the research is in progress.

It is for this reason among others that we always in our laboratory encourage much research that has little or no immediate application to practical problems, confident that if the work is well done the practical justification will follow. I could cite many illustrations of the justification of our faith, but Langmuir's work on the Edison effect is as good a case as any.

I do not mean that we scorn practical problems. The greater part of our work is directed to the solution of such problems. Some factory has run into trouble and asks to be pulled out. Some designing engineer needs a new alloy or new molded compound with certain properties and asks us to develop it for him. Such appeals always have first claim on our efforts, whether the answer comes in a few hours or in many months. Sometimes these bread and butter jobs bring results of scientific interest and wide application.

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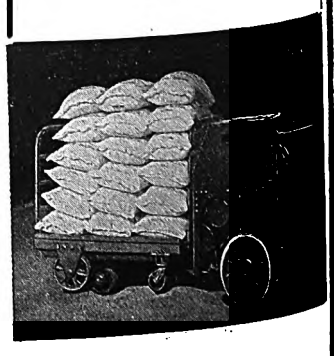
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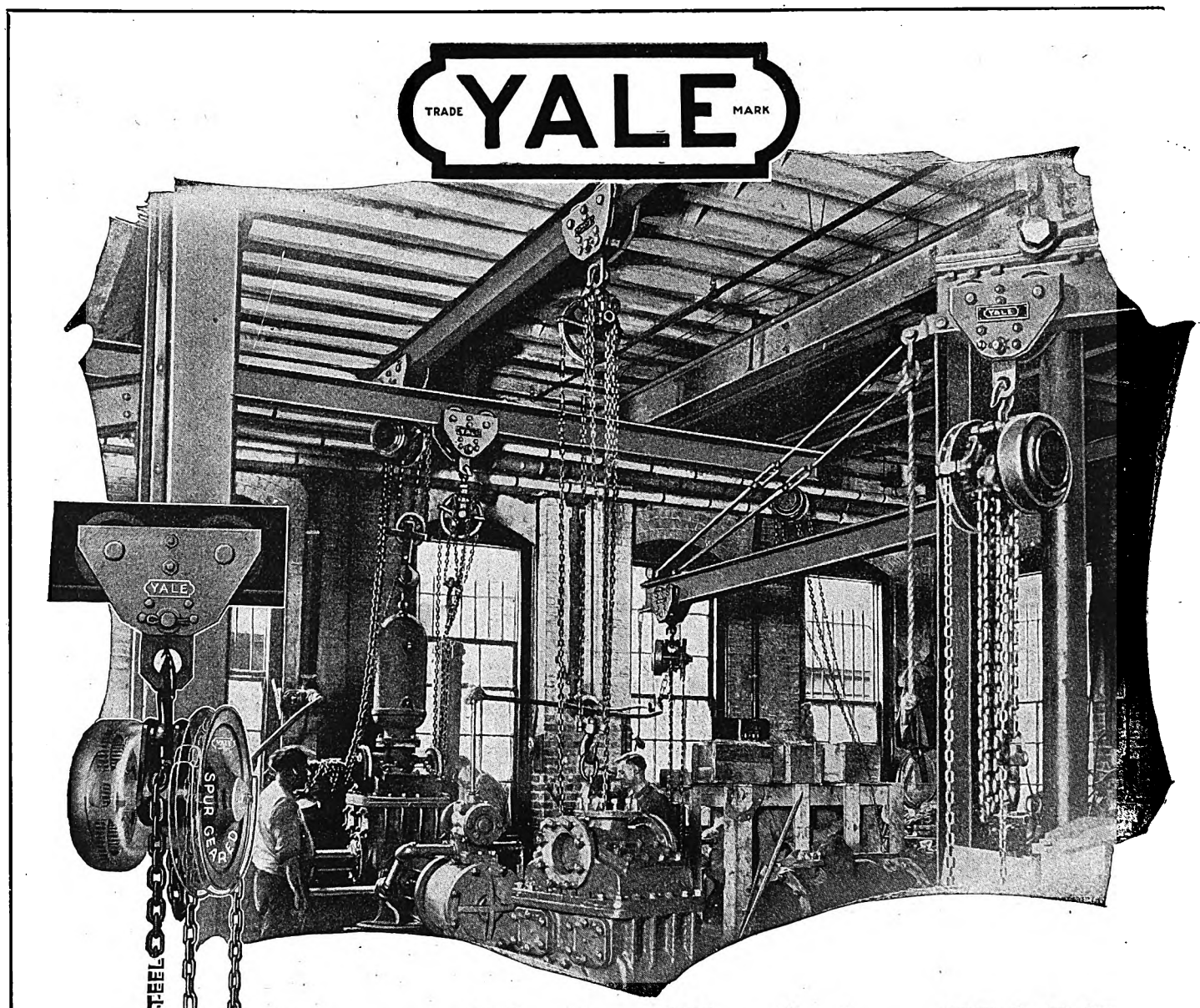
that work originates in the laboratory. We have groups continually at work on incandescent lamps, radio tubes, X-ray tubes, transformer steel, alloys, molded compounds, insulating varnish, lubrication problems, etc.

Again it is frequently necessary or desirable for the laboratory to develop and manufacture for a time some new material or device before turning it over to a factory department. This was done with drawn tungsten wire, magnetite electrodes, X-ray tubes, radio tubes, several different insulating materials, etc.

We regard it as our primary duty to serve the company that supports us by helping other departments in all possible ways to improve their products and manufacturing methods, and to increase the scope of the company's business by developing new devices and materials. But always we devote as much effort as possible to pure science. Each kind of work helps the other. Science is always yielding new riches to be practically developed, and the contact with practical things helps the scientific worker to keep his perspective. The two advantages an industrial laboratory has over a college laboratory are, first, greater facilities for getting things made, and, second, the close contact with real problems. You remember the Greek myth of Antaeus who gained strength from each contact with Mother Earth. Meredith in poetry and prose reiterates the same thought, that humanity must "touch earth" to keep health and sane. That contact is as salutary for science as for human nature. Because of these advantages the industrial laboratory should play an increasing part in the advancement of science.

But a large industrial laboratory must be a growth. It is said that Athena, goddess of science, sprang full grown and fully armed from the brain of Zeus, but we cannot do that sort of thing nowadays. The failures I spoke of earlier were the result of attempts to begin with a full grown laboratory. No man ever lived who could take a big new laboratory and make a success of it. The successful laboratory is built of men, and true research men, like true poets or true artists, are hard to find. Men with promise must diligently be sought, and as they are found one by one their special aptitudes must be developed and the right problems fitted to these aptitudes.

To an engineer that statement may sound overdrawn. I find few engineers recognize the wide difference between engineering and research, but the difference is very wide. It is very seldom that aptitude for both are found in one man. The mental attitude required is fundamentally different. The engineer is the type that likes to deal with certainties. He likes to utilize known materials, whose properties he knows and has confidence in, and to produce therefrom concrete results in the way of new structures, new devices. He likes to see the tangible result of his labors. The research man is primarily interested in the unknown. He seldom has the patience to carry a new idea through to a finished design. He differs from the engineer as the pioneer differs from those who come after him to develop what he has found. Kipling well expresses that ceaseless urge toward the un-



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known, in his poem, "The Explorer":

"Till a voice, as bad as Conscience, rang interminable changes
On one everlasting whisper day and night repeated, so:
'Something hidden, go and find it. Go and look behind the range.
Something lost behind the ranges. Lost and waiting for you. Go'—"

It is this restlessness in the face of the unknown, that trait which Kipling elsewhere characterizes as "insatiable curiosity" which marks the research man, but to be successful he must also have the gift of observing and questioning even the commonplace. Just as to the poet "a primrose by the river's brim" was "something more," so the spreading of oil on a river's surface, which was to others merely a pretty, irridescence or an obnoxious fouling of the water, was to Langmuir a method of measuring the exact dimensions of the oil molecule, and distinguishing one oil from another. The research man also needs the scientific imagination to construct hypotheses, the analytical ability to devise the crucial experiments to test the hypotheses, the resourcefulness, manipulative skill, and persistence to carry through the experiment, the perspective which distinguishes the essential from the non-essential, and the reasoning which coördinates individual facts into a principle.

We need to seek such men, and in Capt. Cuttle's language, "When found, make a note of." We need such men in industrial laboratories, but we need them equally in colleges and universities, to inspire and to train students with aptitude for research. With the necessary effort, the men can be found and research widely developed. Germany has shown it can be done, and the British Empire and the United States should be able to outstrip Germany, for we have one thing that the German lacks, the inborn spirit of team play. In the German laboratories before the war, each laboratory room was under lock and key. No one but the general manager knew what was going on outside of his own room. We don't do things that way. We can coöperate without jealous friction, for the good of the team, and in that way the output rises nearly in geometric proportion to the number of workers, for each helps all the others. Research will do for all our industries what it has already done for the General Electric Company and others. And if ever another war comes, as we pray it will not, our large industrial laboratories will be among our greatest military assets. Some nine months after the United States entered the World War, a visitor from the British Admiralty to our laboratory commented on the speed, to him remarkable, in getting our submarine detectors developed and into quantity production, and he attributed our advantage over England in this respect to the fact that our physicists, designing engineers, and factory men were all trained through years of peaceful development to work as a team with huge resources to back their efforts. The next war, if it comes, will more than ever before be a war of applied science.

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Before me, a Notary Public in and for the State and County aforesaid, personally appeared John H. Van Deventer, who, having been duly sworn according to law, deposes and says that he is the President of the INDUSTRY ILLUSTRATED, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse side of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, Engineering Magazine Company, Cooperstown, N. Y.; editor, John H. Van Deventer, Cooperstown, N. Y.; managing editor, none; business manager, Harvey Conover, Jr., Cooperstown, N. Y.

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent. or more of the total amount of stock.) Engineering Magazine Company, Cooperstown, N. Y.; John R. Dunlap, Cooperstown, N. Y.; J. R. Dunlap, Jr., New York, N. Y.; John H. Van Deventer, Cooperstown, N. Y.; Harvey Conover, Jr., Cooperstown, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages, or other securities are: None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

JOHN H. VAN DEVENTER.

Sworn to and subscribed before me this 2nd day of October, 1923.

CHAS. R. GOETZ.

(My commission expires March 30, 1924.)

Is Industry a "Cold, Relentless" Machine?

(*Continued from page 9*)

which American engineers are leading.

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"Another instance of national importance in securing coöperation between management and employees is being worked out in the great Pennsylvania Railroad under the leadership of General Atterbury. The confidence which the employees of the Pennsylvania Railroad manifest in General Atterbury and the men under him, most of them engineers, is one of the milestones in this movement toward successful human engineering.

"There are many other organizations, many groups of men, in this country engaged in this movement toward the perfection of human engineering, and it is a movement which will promote not alone the material well being of our civilization, a movement which will continue to produce big things, but is also a movement in which American engineers can well take even greater pride, for the production of great men."

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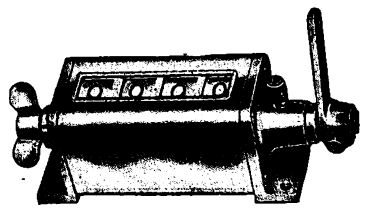
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The small Revolution Counter below registers one for a revolution of a shaft, recording a machine operation, or product. Though small, this counter is very durable; its mechanism will stand a very high rate of speed, making it especially suitable for light, fast-running machines, and most adaptable to experimental work. If run backward the counter subtracts. Price $2.00. (*Cut 3/5 size.*) Small Rotary Ratchet Counter, to register reciprocating movements of small machines, also $2.00.

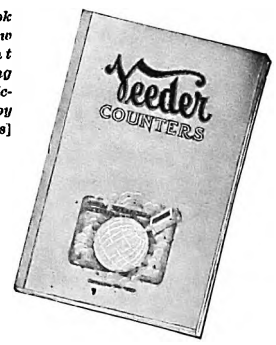


The Revolution Set-Back Counter below records the output of any machine where a shaft-revolution indicates an operation.



Sets back to zero from any figure by turning knob once round. Supplied with from four to ten-figure wheels, as required. Price with four - figure wheels, as illustrated, $10.00—subject to discount. *Cut less than one-half size.* Set-Back Rotary Ratchet Counter to record reciprocating movements as on punch presses, $11.50 (list).

This book shows how to count everything automatically. Copy [80 pages] Free.



The Veeder Mfg. Co.
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Salary List, or Pay Roll?

By K. M. Coolbaugh

Superintendent, State Employment Office, Philadelphia

THE other day the telephone rang and an old customer up the State, who is the power distribution superintendent of a large interurban traction line, was at the other end of the wire.

"I want eight linemen for the same class of work as that for which you got us men about two years ago. We are building an extension and want them for permanent work. If you can line up about ten or fifteen for me and I will be down Monday to interview them."

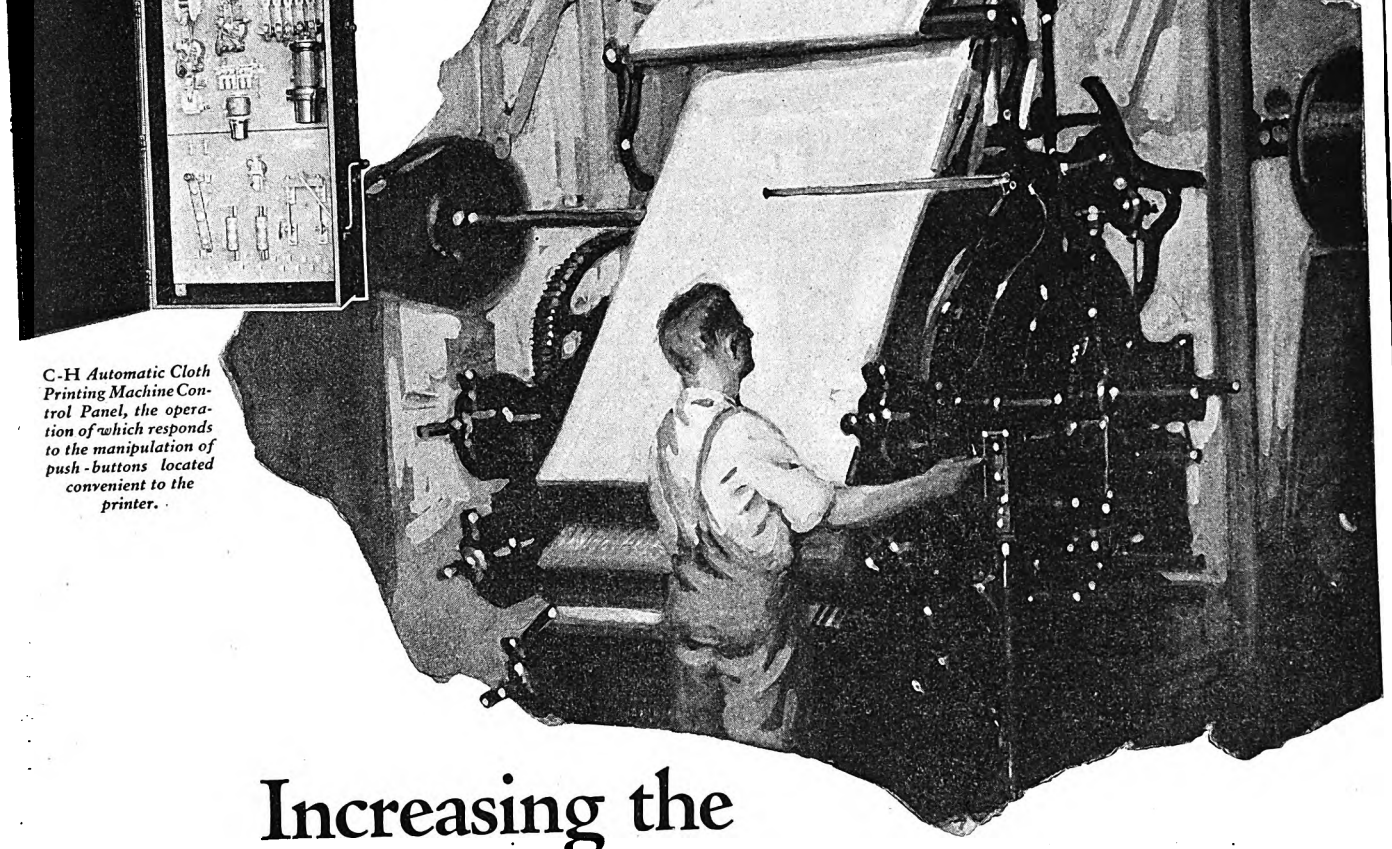
I gave the order no more special thought than the usual run of orders which come to the office daily by letter, telephone and personal calls.

But the following Monday morning the traction official came to our offices, was assigned to a room for interviewing the men, whom we had procured for him, and at once started the sifting out process. And later in the day I learned he had interviewed ten applicants, eight of whom he had hired. The wages which he offered were substantially no higher than those paid locally, so that when he came up to my office to say good-bye before leaving with six of his new employees, I was led to ask him how he had obtained these men so quickly.

He smiled and replied: "It wasn't the rate that got them; it was the proposition!"

Here is his proposition as he outlined it to me:

"Any transportation man knows how vital maintenance men, and especially linemen or trouble shooters, are to railway operation. For years we fiddled around with hourly rates, bonuses, time and a half, double time, and Heaven knows what. We spent more time in trying to arrive at a satisfactory wage agreement with our linemen than has been wasted in Senate filibusters. The keenest sharks at figures we could obtain sat up in conferences night after night with representatives of the linemen. They arrived at I don't know how many agreements which were endorsed, sealed and delivered with as much good faith on the part of the employees' representatives as upon the part of the management. They seemed to lead us nowhere. It was not usually the question of the base hourly rate that apparently caused our disagreements and misunderstandings; in ninety per cent. of the cases it was our inability to work out the question of overtime, Saturday afternoon, Sunday and holiday work to complete satisfaction.



C-H *Automatic Cloth Printing Machine Control Panel, the operation of which responds to the manipulation of push-buttons located convenient to the printer.*

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"So you hit upon your monthly salary proposition!" I ventured.

"I'll say we did," he went on, 'and it has come nearer to solving most of my so-called labor problems than any move I have made. It was because I offered those eight men whom I employed today a monthly salary which they can bank on in spite of lightning and high water that they snapped at the job. As a matter of fact, we threw the hourly rate proposition so far as it affects linemen into the discard a year ago. It happened this way: Traffic was slack with us and we were compelled to drop a number of our men. I was sick and tired dickering. I told the linemen I would pay them a straight monthly salary which they would receive once a week; that they could bank on that salary month in and month out so long as we had need for their services and so long as they did the work. I named a salary which roughly was about $20.00 less per month than they had been averaging on an hourly basis. They nearly took me off my feet by accepting the proposition. That is the result today? For a year our entire force of linemen have worked on a straight salary basis, precisely as I, all our office employees and the officials of the company work. It has tied them up to the company and to their job tighter than any means so far attempted or suggested. I am so completely sold to the salary basis for all employees, regardless of their job, that if it were practicable and agreeable to all employees of our company I would put it in force tomorrow morning.

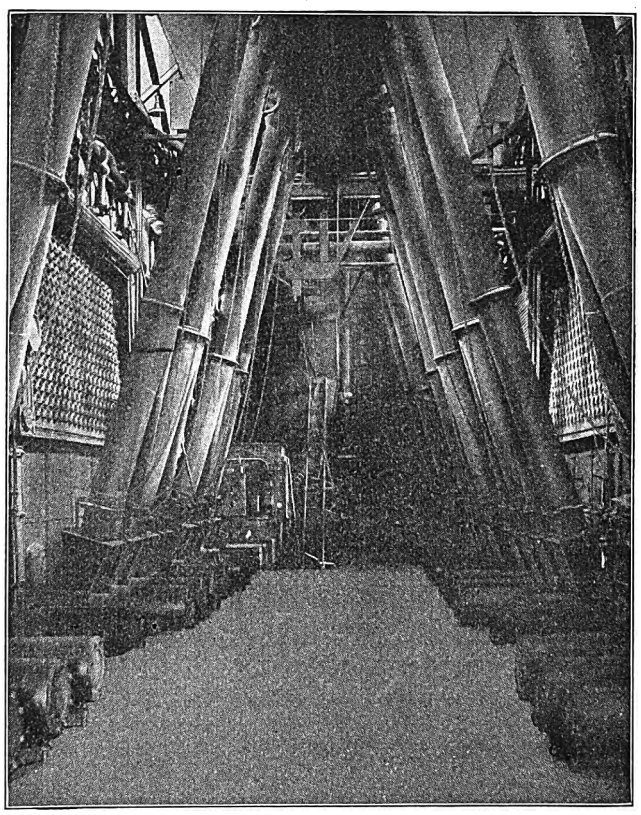
"Before we instituted the salary idea, our linemen seemed to have but one thought in mind: that was how to make the greatest amount of overtime. There seemed to be a conspiracy to loaf on the job for eight hours straight time and then obtain as much work as possible Saturday afternoon at time and a half, and Sundays and holidays at double time. They were out to get all the traffic could stand. I am not blaming them at all. I haven't a doubt that clerks and probably many executives would resort to the same questionable practice if they were on an hourly basis and could see a chance to make more money by loitering and stringing the job along. Believe me, these men had it down to a science.

"All that is past. Today nearly every one of these men is a company man from the word go. They are out to give the best that is in them in the shortest time possible. They seem to have a mania for shooting trouble wherever it shows its head; and like the Northwest Mounted Police, when they shoot it's usually only once at the same target and then they are waiting for more trouble. Night work, Sunday work, in fact nearly all work which we formerly classed as overtime is no longer performed, except in time of great emergency.

"But how do you apportion your overtime and emergency work?" I interrupted. "Isn't there friction and hard feeling when one of your linemen has to go out on a hurry call at night, or on the Fourth of July?"

"There hasn't been a kick worthy of the name," he answered. "If a lineman does a job during hours which were formerly classed as overtime, he is entitled to a lay off on a week day time equivalent to the hours in which he did emergency

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work. For instance, if Sunday work is necessary, a man can pick out his day off during the following week. Instead of a conspiracy or a gentlemen's agreement, if you want to call it that, to increase the pay envelope as in the old days, each man takes it on himself to see that every other man does an honest day's work and carries his share of the load. We have weeded out only two of our entire force during the past year. Those two men were dismissed, not because of delinquencies reported by their foreman, but because they had become so unpopular with the rest of the crew for soldiering on the job that common sense and fairness to those who were doing the work dictated their removal from the payroll; in fact, the recommendation for dropping those two men came from their fellow workers.

"Yes, sir," he concluded, "I am for the straight salary proposition, and I am bending every effort to have it cover every job in my department. It will take time, but because it takes time, the job, when it is finished, will be well done."

Two days later when he telephoned me to place an order with the office for a number of technically trained engineers, I asked him whether all of the men whom he had employed on the previous Monday had shown up at the railway station at the appointed time for leaving.

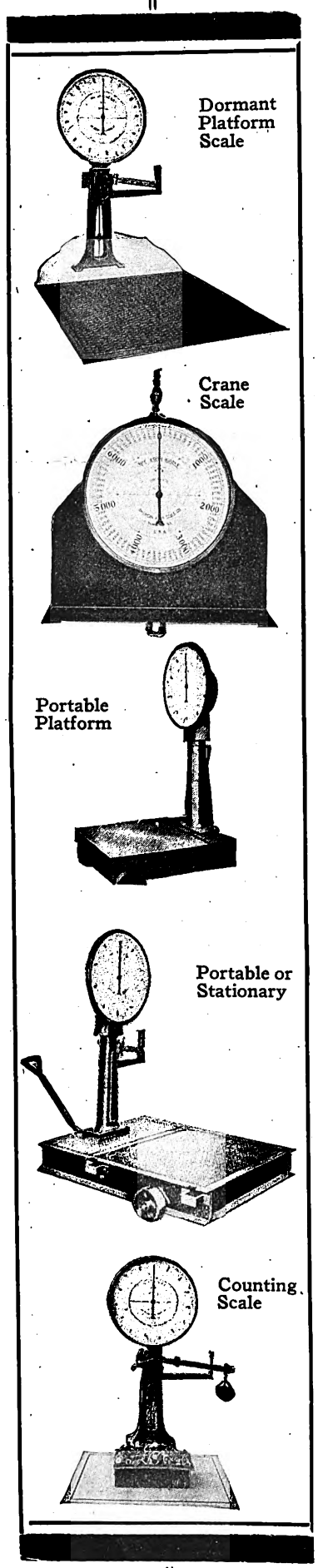
"The six not only showed up, but this morning I got a letter from the two men whom I had employed that wanted to serve out a ten-day notice with their present employers, asking me to be sure to hold their jobs open."

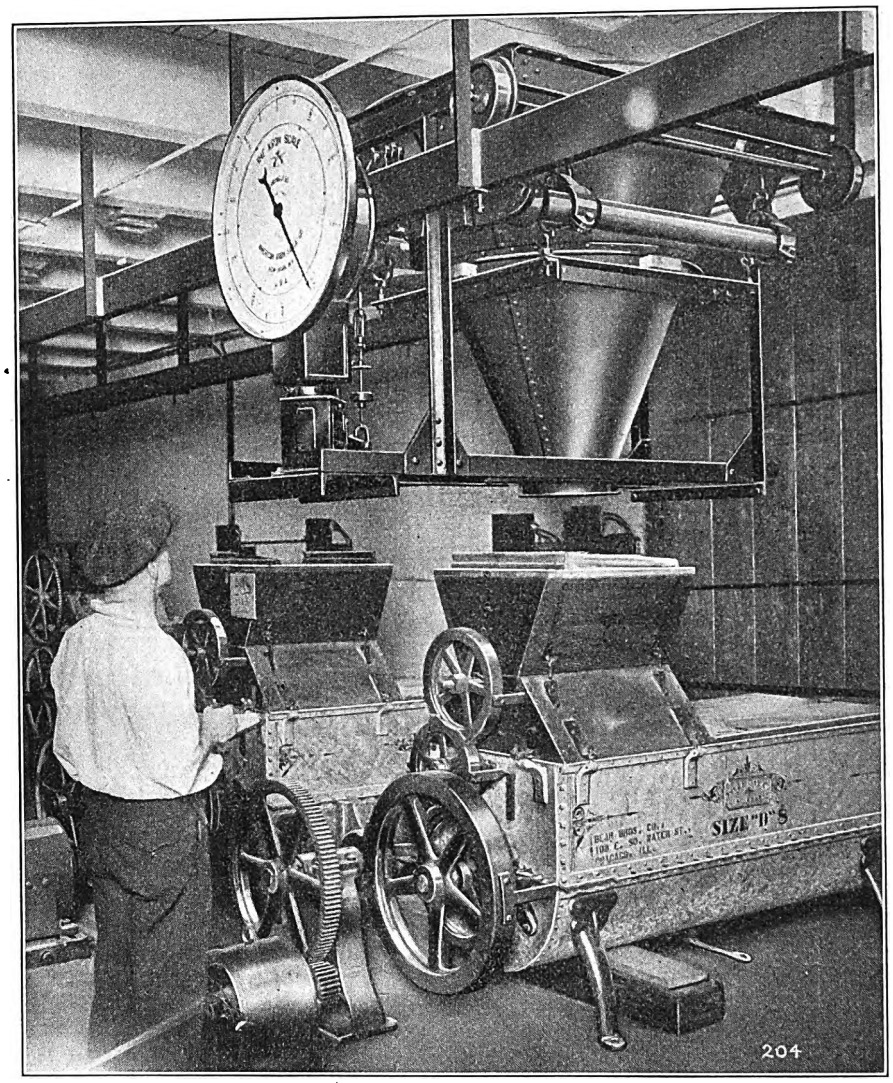
All men who have engaged in employment work and the recruiting of labor during periods of great business prosperity and its concurrent labor shortage know only too well how small is the percentage of mechanics whom they employ who actually show up for shipment to the job or appear at the appointed time at the plant employment office. Employment men who have been in the business any length of time frequently engage twenty-five, or in some cases fifty per cent. more men than they are actually seeking. They do this with the firm conviction that the surplus will change their minds.

It is for this reason that the experience of this traction superintendent interested me especially, because I know that what he had to offer must have been of paramount interest to the eight men employed, all of whom had kept their promises. His experience is all the more significant because it took place in a period of acute labor shortage, when all around him employment men and labor agents were engaging ten mechanics when they wanted five, or fifty common laborers when they wanted ten.

The incident is one of the few in the records of this office where all of the men engaged by an employer actually showed up on the job ready to work.

Whether we wish to admit it or not, there is and always has been a line, tangible but invisible, which separates the man in the shop from the man in the office. There is but one sound reason for the existence of this line. That reason, as I see it, is the distinction, arbitrary or necessary, which the hourly wage basis and the salary basis of themselves create. It is the result of placing two sharply contrasting ideas side by side. It is one of our industrial Mason and Dixon lines which will





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e wiped out only when the contrast which creates it is gone.

In an industry, not many blocks from my office, there is a machinist whom I have known for years. For eleven years he has worked for this industry as power maintenance man. During this time his wages have been on an hourly basis. But he has been and will always be a loyal company man, regardless of the amount or basis of his pay.

Across the street from him lives a shipping clerk who has been with this same industry for two years. He is of the indoor sports type of the comics. He is paid a monthly salary for toasting the company and its officials from the boss down.

During the recent recurrence of the flu epidemic, both of these men were taken sick and were absent from their work for nearly three weeks.

When he recovered, the chronic kicker with two years' service was paid his salary without deductions, while when the loyal veteran of the power house, who happened to be on an hourly wage and who punched the clock returned to the job, he found his pay envelope among the missing. His pay had stopped automatically the morning he had failed to check in at the plant. He either made a kick or nursed a grouch. The only comment I heard him make when he heard that his white collar neighbor had been paid for full time was in good nature and with a shrug of the shoulders:

"Oh, I guess it's all right. Things have always been that way!"

But rancor and resentment might well have been the fruit. Preventing these commonplace injustices can be done more easily and effectively by manufacturers and merchants than by construction and building employers. Most of the country's mercantile establishments, such as department stores and banks, pay all of their employees on a weekly or a monthly salary basis. It would be a striking exception to the rule to find an employee on an hourly basis in establishments of this character.

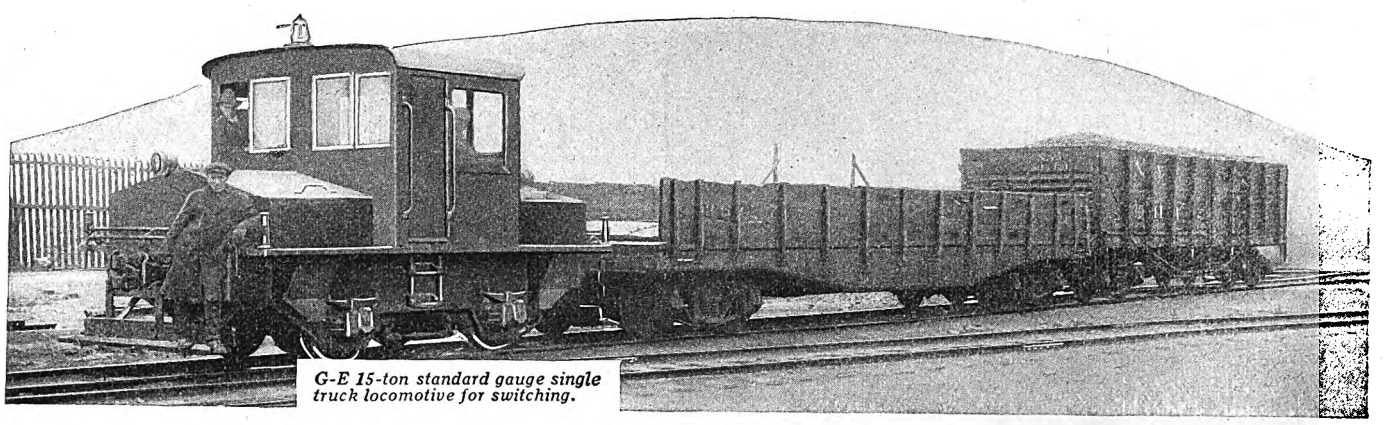
Nor in the case of those manufacturing operations in industry where production is upon a piece work or bonus basis would it in many instances be desirable or practical to put in force a blanket policy of this nature.

The road toward this goal, however, is most difficult to travel when an attempt is made to apply the principle or method in the building and construction field. Many factors block it at every turn, such as weather conditions, the keen competition for labor resulting in a heavy labor turnover, and constant wage re-adjustments, due to causes with which every contractor and builder is familiar.

Nevertheless, I have even in those industries seen this tendency to transfer mechanics from an hourly to a salary basis show itself more often during each succeeding year of construction activity.

After all, Industry's greatest problems are not of commodities and their markets. They are problems of human nature. And strangely it is a poet, not a business man, who has given us in one short line a fundamental industrial philosophy which in its broadest sense some of us do not comprehend in a life time:

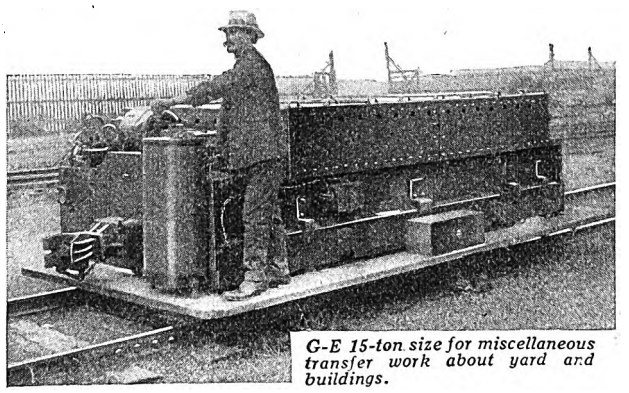
"The Colonel's Lady and Judy O'Grady
Are sisters under their skins."



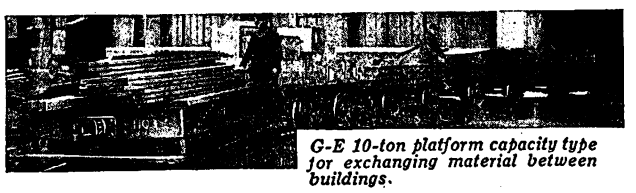
G-E 15-ton standard gauge single truck locomotive for switching.



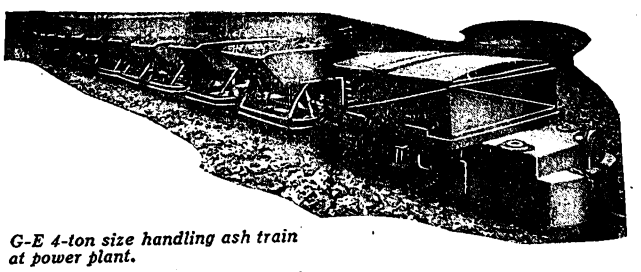
G-E 40-ton combination storage battery and trolley locomotive for heavy duty yard service.



G-E 15-ton size for miscellaneous transfer work about yard and buildings.



G-E 10-ton platform capacity type for exchanging material between buildings.



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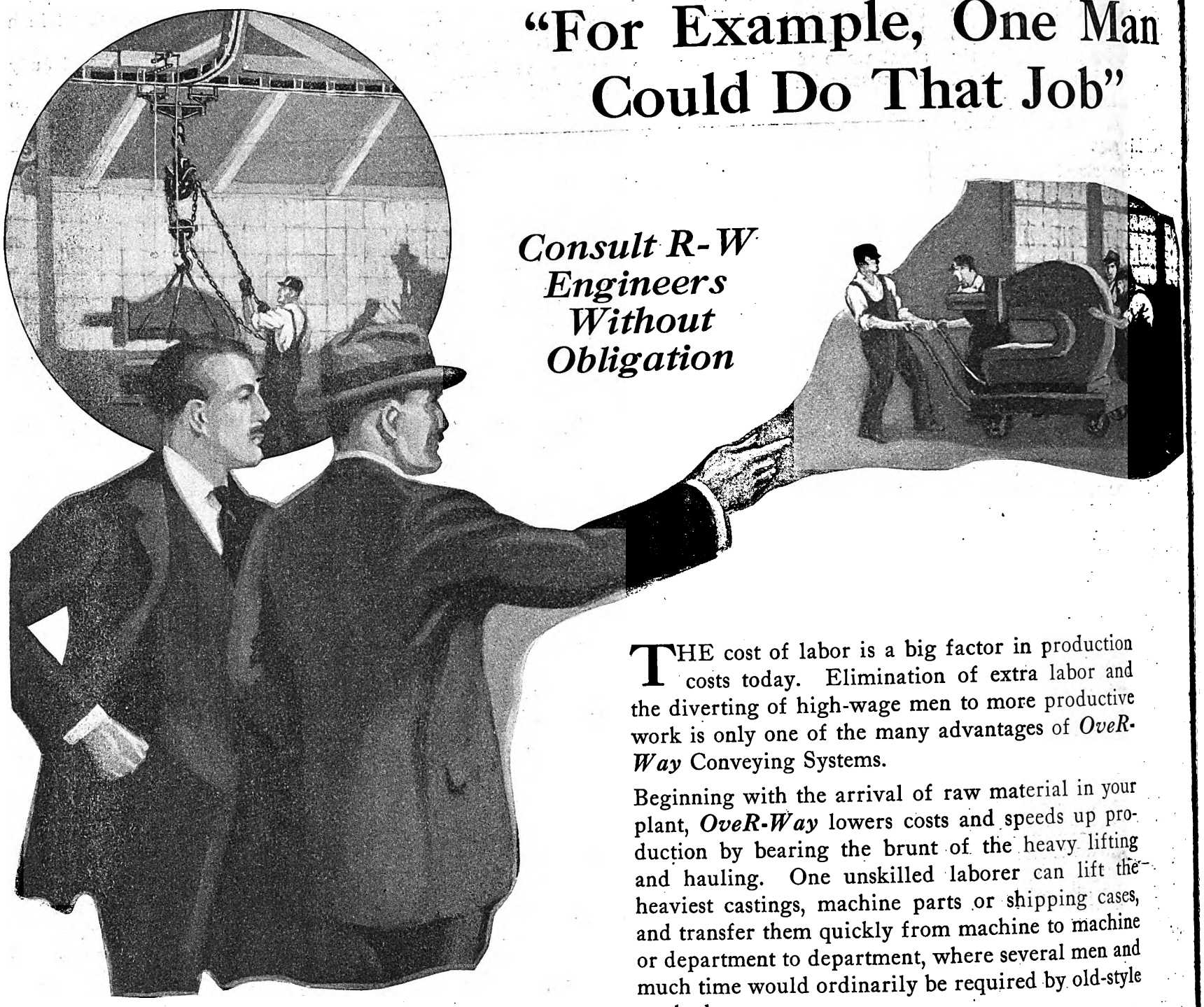
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